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TABLE OF CONTENTS FIRST PAGE

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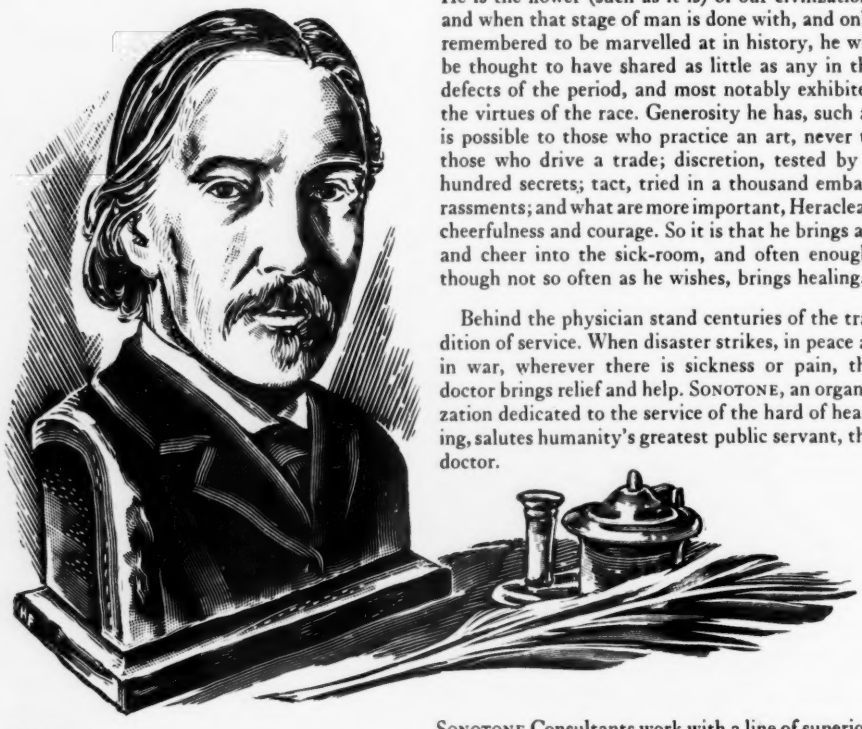

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CONTENTS

Original Articles

Carcinoma of the Middle Ear and Mastoid PAGE
J. William Wahl, M.D., Los Angeles, and Maurice T. Gromet, M.D., Brooklyn 121

Ménière's Syndrome
Miles Atkinson, M.D., F.R.C.S. (Eng.), New York 127

Use of Tantalum in Otolaryngology
Ernest E. Scharfe, M.D., Montreal, Canada 133

Bilateral Abductor Paralysis
DeGraaf Woodman, M.D., New York 150

Sinusitis as Focus of Infection in Uveitis, Keratitis, and Retrobulbar Neuritis
Francis L. Weille, M.D., and Rolf R. Vang, B.A., Boston 154

Sugar and Chloride in Fluid from Intranasal Cysts
John C. Lillie, M.D., Rochester, Minn. 166

Septoplasty for Correction of Deviation of Nasal Septum
Joseph S. Stovin, M.D., New York 168

Effect of Chromates on Nose, Throat, and Ear
Jack B. Miller, M.D., Portland, Ore. 172

Cysts of the Larynx
D. J. Morgenstern, M.D., and A. M. LaSala, M.D., Brooklyn 179

New Technique for Corrective Surgery of Nasal Tip
Irving B. Goldman, M.D., New York 183

Case Reports

Intranasal Encephalomeningocele
G. S. Fitz-Hugh, M.D., Charlottesville, Va. 188

Complete Obstruction of the Esophagus by a Weight-Reducing Tablet
Jawad Hedayaty, M.D., and Charles R. Shuman, M.D., Philadelphia 190

Treatment of Mixed Tumor of Tongue with Radioactive Chromic Phosphate Solution
Claude S. Mumma, M.D., Los Angeles 192

Clinical Notes, New Instruments and Techniques

Modification of the Jackson Esophagoscope
A. Albert Carabelli, M.D., Trenton, N. J. 196

Device to Cover Indwelling Tracheotomy Tube
John D. Kernan, M.D., New York 199

(Continued on Next Page)

CONTENTS—Continued

Intrabronchial Bougies PAGE
Ernest B. Emerson Jr., M.D., Rochester, N. Y. 201

Improved Position for Bronchoscopy and Esophagoscopy
Joseph M. Miller, M.D., and Milton Ginsberg, M.D., Fort Howard, Md. 203

Adenoid Pressure Roller for Hemostasis in Adenoidectomy
Max Unger, M.D., New York 204

Progress in Otolaryngology

Functional Examination of Hearing
Alfred Lewy, M.D.; Sherman L. Shapiro, M.D., and Norman Leschin, M.D., Chicago. 205

Regular Departments

Directory of Otolaryngological Societies 233

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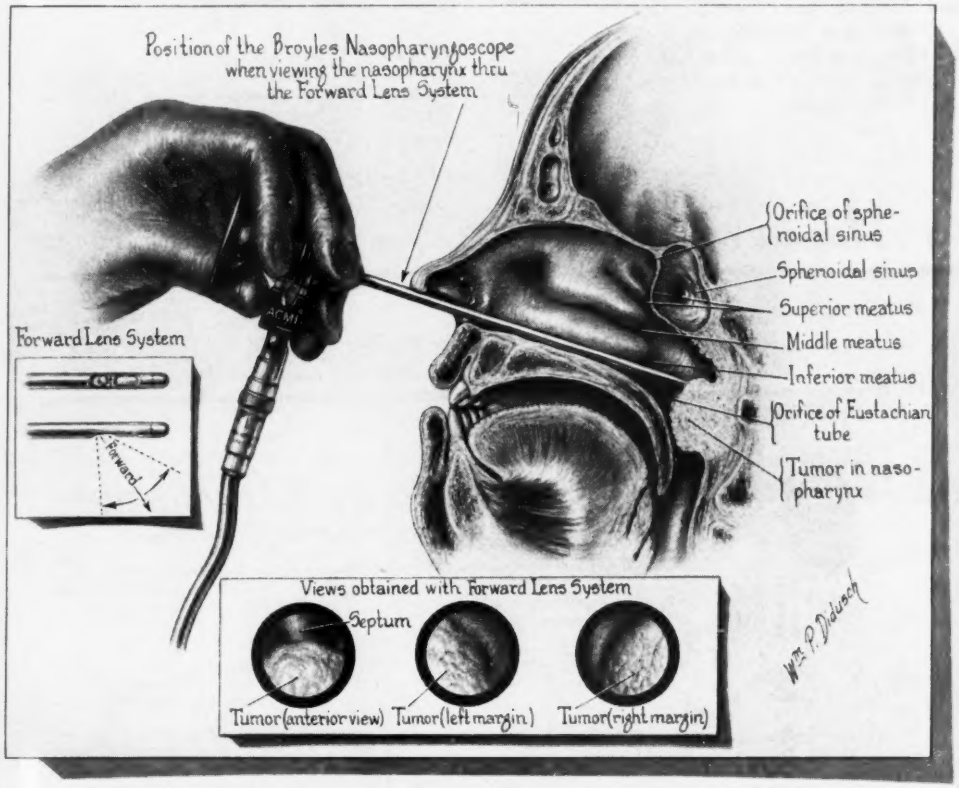

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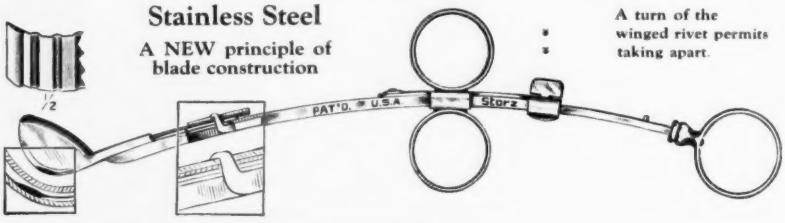

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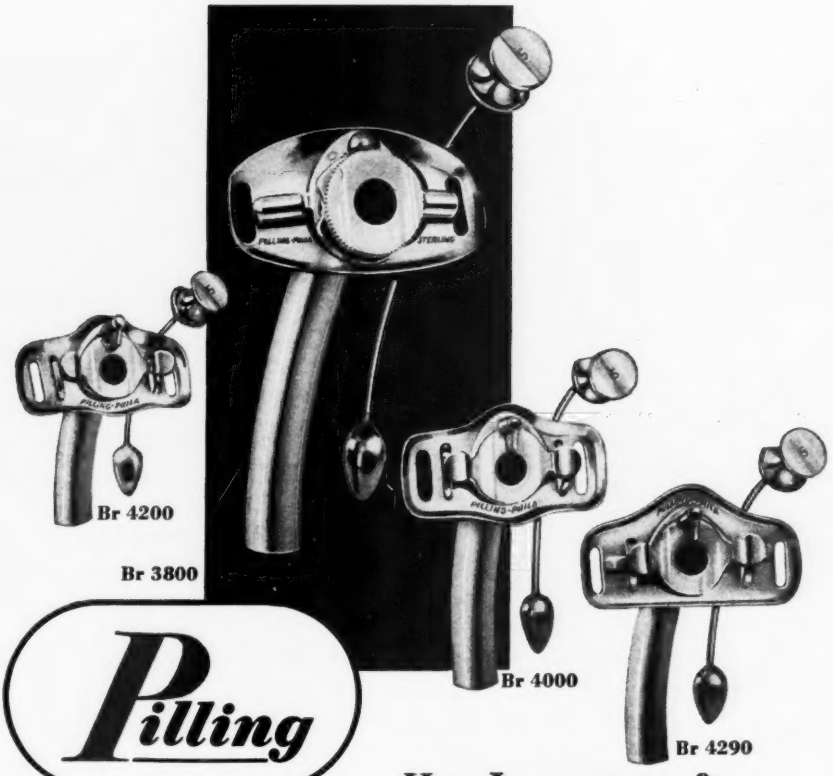

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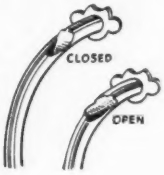

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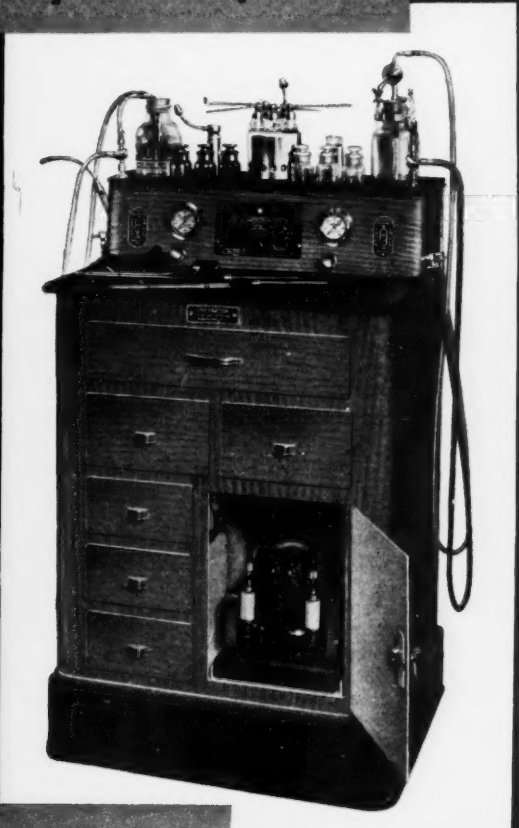

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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 58 AUGUST 1953 NUMBER 2

COPYRIGHT, 1953, BY THE AMERICAN MEDICAL ASSOCIATION

CARCINOMA OF THE MIDDLE EAR AND MASTOID

J. WILLIAM WAHL, M.D.
LOS ANGELES
AND
MAURICE T. GROMET, M.D.
BROOKLYN

THE CLASSIFICATION of new growths of the ear based on origin comprises three types: (1) extrinsic, in which only the auricle, concha, or external canal is involved; (2) intrinsic, which involves the tympanic membrane, tympanic cavity, or mastoid process, and (3) indeterminate, the origin of which cannot be accurately ascertained. In this report, only intrinsic carcinomas will be discussed.

Malignancy of the middle ear and mastoid process is relatively rare; among about 700,000 patients treated in the otorhinolaryngologic service at the Brooklyn Eye and Ear Hospital in the past 17 years, only 8 cases are on record. Towson and Shofstall [1] noted only 0.0016% of 1,883 patients admitted in a two-year period at Jefferson Hospital, Philadelphia, to have carcinoma of the intrinsic type. During a six-year period at the Mayo Clinic, Figi and Hempstead [2] reported an incidence of 0.003%. Mattick and Mattick [3] found approximately 1 case among 7,000 cases seen at the Roswell Park Memorial Institute in Buffalo. These cancers comprise about 1.5% of carcinomas about the ear.

Stokes [4] stated that he has seen these new growths in patients ranging in age from 3 to 90 years, although the age incidence is the same as for other malignant conditions, most cases occurring in the middle decades of life. In our series, the average age was 51.6 years, there being five females and three males.

The cancers are usually found to be squamous-cell epitheliomas upon histopathologic examination. This was true in six of our eight cases, the other cancers being a basal-cell carcinoma and an adenocarcinoma. The last two were really extensions of extrinsic lesions, but since they presented the appearance of primary lesions, they are included. They were believed to be intrinsic until examined micro-

From the service of Dr. E. A. Griffin at the Brooklyn Eye and Ear Hospital.

1. Towson, C. E., and Shofstall, W. H.: Carcinoma of the Ear, Arch. Otolaryng. **51**:724, 1950.

2. Figi, F. A., and Hempstead, B. E.: Malignant Tumors of the Middle Ear and Mastoid Process, Tr. Am. Acad. Ophth. **47**:210, 1943.

3. Mattick, W. L., and Mattick, J. W.: Some Experiences in Management of Cancer of Middle Ear and Mastoid, A. M. A. Arch. Otolaryng. **53**:610, 1951.

4. Stokes, H. B.: Primary Malignant Tumors of Temporal Bone: Report of Case, Arch. Otolaryng. **32**:1023, 1940.

scopically. Beck,[5] Bryant,[6] Figi and Hempstead,[2] and Mattick and Mattick [3] reported cases of angioendotheliomas. Sarcomas have also been found in this region.

Peele and Hauser [7] state that some observers believe the carcinoma originates in the external auditory meatus with extension inward to involve structures of the middle ear, while others believe it originates deep in the canal or membrana tympani with secondary involvement of the middle ear. Barnes [8] said that a large number of cancers probably originate in the lining of the mastoid cavity, which has become altered during a prolonged suppuration. According to Pause, a malignant neoplasm that originates in the tympanic cavity probably results from a metaplasia of the cylindric cells of the lining membrane to the squamous-cell type or has its origin from the glandular elements within the cavity. Smith [9] believes that, although these tumors are of the squamous type and the tympanic cavity is lined with columnar

Fig. 1.—Photograph of patient showing paralysis of left side of face.

cells, the sustained irritation of chronic middle-ear suppuration can change columnar into squamous epithelium.

In practically all cases reported in the literature, the patient gave a history of chronic middle-ear infection. The average duration of ear discharge was 26 years in the eight cases of this series. Four of the diagnoses were made from biopsy specimens or the removal of aural polypi, although one patient had polypi removed twice

5. Beck, J. C.: Angio-Endothelioma of the Middle Ear: Report of Case, Illinois M. J. **9**:137, 1906.

6. Bryant, W. S.: A Case of Carcinoma of the Middle Ear, Probably Endothelioma, Ann. Otol. Rhin. & Laryng. **16**:301, 1907.

7. Peele, J. C., and Hauser, G. H.: Primary Carcinoma of the External Auditory Canal and Middle Ear: Review of Literature; Report of Case of Cystic Adenoid Epithelioma (Brooke's Tumor) of External Auditory Canal, Arch. Otolaryng. **34**:254, 1941.

8. Barnes, E. B.: Carcinoma of the Ear, Proc. Roy. Soc. Med. (Sect. Otol.) **23**:67, 1930.

9. Smith, C. H.: Primary Carcinoma of Middle Ear and Mastoid: Endaural Approach to Mastoid, Laryngoscope **50**:547, 1940.

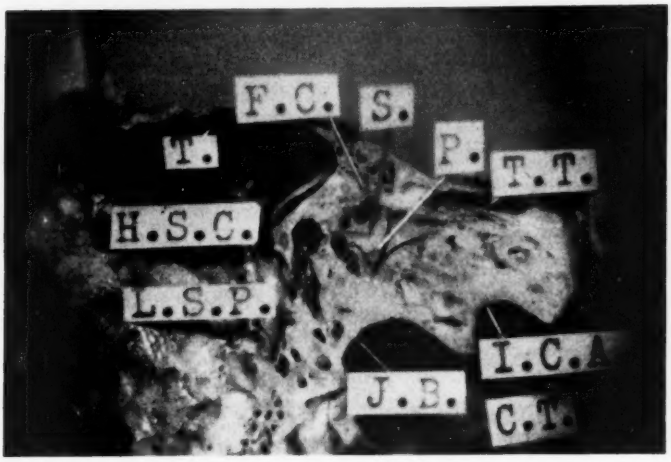

Fig. 2.—Oblique section through a temporal bone showing relative positions of some structures contained in middle ear and mastoid bone: *T.*, tegmen; *H.S.C.*, horizontal semicircular canal; *L.S.P.*, lateral sinus plate; *J.B.*, jugular bulb; *C.T.*, region of chorda tympani; *I.C.A.*, internal carotid artery; *T.T.*, tensor tympani muscle in processus cochleariformis; *P.*, promontory; *S.*, stapes in oval window; *F.C.*, Fallopian canal for horizontal portion of facial nerve.

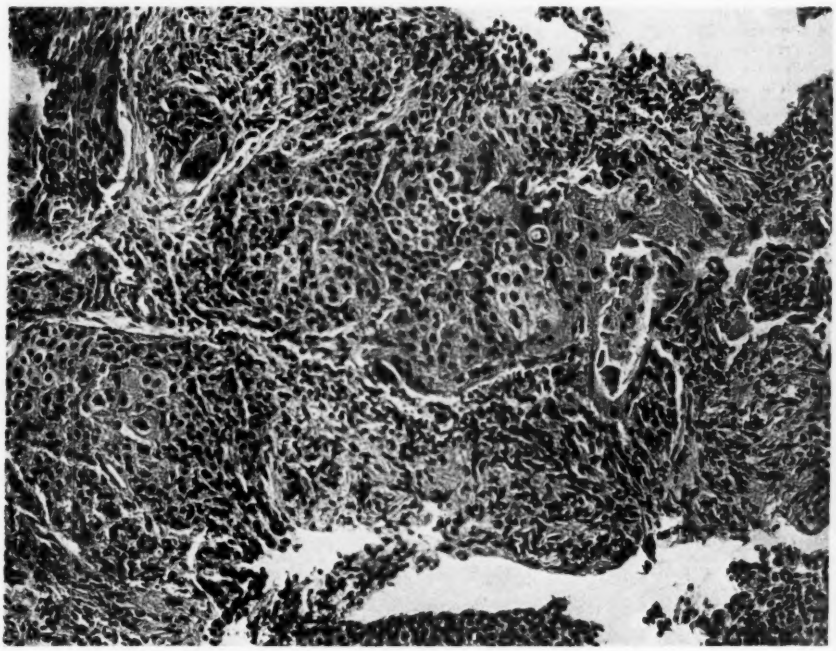

Fig. 3.—Photomicrograph of tissue removed from middle ear and mastoid antrum at time of endaural radical mastoidectomy.

and called benign before a malignant change became evident after examination of a third specimen. Constant pain in and about the ear of increasing severity first prompted three of the eight patients to seek medical attention. Facial paralysis was present in 7 of 38 cases reported by Figi and Hempstead,[2] and of 10 patients seen by Barnes [8] seventh-nerve paralysis developed in 2 simultaneously with the pain and in 7 later in the course of the illness. Three of our eight patients presented this sign on admission to the clinic.

Clinical appearance is of only moderate assistance in arrival at the proper diagnosis. Because of the long-standing otorrhea usually present, audiometric studies as a rule are of little value. The inflammatory changes that have taken place often have lowered the hearing threshold below that of serviceable hearing. Rather sudden deafness occurring in a patient with an imperforate membrana tympani without a history of recent otitis or other inflammatory process that may affect hearing, such as mumps, should lead one to suspect tumor of the middle ear. Unfortunately, it is not known when a chronically draining ear will first exhibit malignant changes. Of course, one cannot perform a radical mastoidectomy on every chronically draining

Cancer of the Middle Ear and Mastoid

Primary or Secondary	Sex	Age	Ear	Facial Paralysis *	Pain *	Bleeding *	Vertigo *	Duration of Discharge	Pathologic Exposure of Dura *
Primary	F	61	AD	+	++	+	+++	47 yr.	++
Primary	F	53	AS	+++	++	—	+++	42 yr.	—
2d, to canal	F	29	AS	+++	++	+	++	3 mo.	—
Primary	M	57	AS	—	+++	—	+++	1 yr.	—
Primary	M	75	AD	—	++	+++	+++	40 yr.	++
Primary	M	44	AD	—	++	—	+++	25 yr.	—
2d, to salivary gland tumor	F	30	AS	+++	++	—	—	1 yr.	—
Primary	F	64	AD	+++	+++	—	—	26 yr.	++

* Basis of grading: +, slight; ++, moderate; +++, marked.

ear, but in any case in which resistant granulations or polyps develop in the ear or there is a recurrence of drainage with otalgia, there should be an exploration. X-ray studies seldom help in preoperative diagnosis but may disclose evidence of metastasis.

The treatment of malignancy of the middle ear and mastoid is rarely satisfactory, because of the advancement of the lesion when discovered. A complete radical mastoidectomy, by either the postauricular or the endaural route, is the surgical procedure of choice, to be followed by therapy with both radium and high-voltage x-rays to the affected area.

Intracranial involvement is the usual cause of death in such cases. In three of our eight cases, neoplastic tissue was found to be already present on dura which had been pathologically exposed at the time of operation. Owing to the lack of facilities, all eight patients were referred to the Brooklyn Cancer Institute for radiation therapy.

REPORT OF A CASE

Mrs. A. S., a 64-year-old white woman, was admitted to the Brooklyn Eye and Ear Hospital on Aug. 22, 1951, with the following complaints: (1) pain in and around the right ear for the past two weeks and (2) paralysis of the right side of the face for the past two weeks. Past medical history revealed that the right ear had first drained in 1925 concomitantly with a right

lateral cervical abscess which was incised and drained. The ear had discharged intermittently during the ensuing 26 years, the discharge usually being accompanied by pain which was not as severe as that present on admission. Abatement of symptoms usually followed conservative medical treatment of the ear during attacks. The drainage was usually somewhat fetid and yellow. On July 25 she began to have severer pain of the right ear and side of the head. Increasing severity of the pain prompted her to seek relief by consulting her dentist. The dentist extracted her right upper first and second molar teeth and planned to remove the remaining upper tooth, the canine, 10 days later. On Sept. 6 she consulted her family physician because the otalgia had increased. At this time she also noticed a weakness of the right side of her face. After examination, the physician referred her to the Ear, Nose and Throat Clinic of the Brooklyn Eye and Ear Hospital. The remainder of the past medical history is noncontributory.

Examination of the patient revealed a complete right facial-nerve paralysis. There were no abnormalities of the soft tissues surrounding the auricle. There was slight tenderness to palpation of the preauricular region and the region over the mastoid bone. The posterosuperior canal wall was swollen and obscured this part of the membrana tympani, which showed a small central perforation of the pars tensa, through which could be seen some yellow drainage in the middle ear. The left membrana tympani was dull and retracted, but intact. Examination of the nose revealed a moderate deviation of the septum to the right, with some irregularity and slight tumefaction of all turbinates. The mouth was almost edentulous and without evidence of dental infection, and the areas of recent extraction were almost completely healed. The tonsils were cryptic and atrophic, and there were no abnormalities or evidence of infection of the nasopharynx. The hypopharynx and larynx were normal in appearance and function. There was a vertical scar 2 in. (61 cm.) in length over the lower anterior border of the right trapezius muscle, but no evidence of cervical adenopathy. The blood pressure was 155/110, and no arrhythmias or murmurs were heard. The lung fields were clear to auscultation and percussion.

X-ray studies of the mastoid bones revealed them to be of moderate size and diploic, with sclerosis bilaterally. The red blood cell count was 4,480,000, with 90% hemoglobin. The white blood cell count was 8,300, with 63% neutrophilic polymorphonuclear cells, 3% mononuclear cells, 33% lymphocytes, and 1% transitional cells. The Kahn test of the blood was negative, as was the urinalysis for sugar and albumin.

Medical consultation was requested to determine the patient's medical status and the risk for surgery. No contraindications were reported.

On Aug. 23 a right endaural mastoidectomy was performed with the following technique. Three endaural incisions were made to allow exposure of the mastoid bone. The skin of the posterior canal wall was excised, and with a cutting burr the posterior-superior canal wall was removed, removal starting above the notch of Rivinus, until the mastoid antrum was entered. The mastoid cells were sclerotic and were removed with the burr, the intact lateral sinus plate being exposed from the sinodural angle to the mastoid tip. The facial ridge was lowered and the horizontal semicircular canal partially skeletonized. The posterior root zygomatic cells were exenterated with a burr. The exposed antrum and the middle ear were filled with a dark granulomatous-appearing mass. This tissue did not appear to be true granulation tissue and bled easily. The mass was removed with dental curettes from its origin in the mastoid antrum and middle ear. This specimen was saved to be examined histopathologically. Its removal revealed the bony Fallopian canal to be absent at the bend and adjacent vertical portion and the mass to be attached to the sheath of the facial nerve. After removal of the mass and remainder of the bony Fallopian canal from the geniculate ganglion through the horizontal portion and down the vertical aspect to the stylomastoid foramen, the sheath of the nerve was split in the direction of the axis of the fibers. The edema of the nerve was relieved by splitting of the sheath, as evidenced by the "popping out" of the nerve from its enclosed sheath. An area of tegmen 1.5 cm. in diameter was absent in the middle-ear region, with fairly normal-appearing dura exposed. The hypotympanum was lowered to the level of the bony canal and the Eustachian orifice curetted. The processus cochleariformis, tensor tympani muscle, and bony semicircular canal were removed, but the stapes in the oval window and the round window were not disturbed. A small piece of gold foil was then placed over the exposed nerve. The cavity was packed with paracin (benzyl benzoate-chlorophenothane-ethyl aminobenzoate) gauze and a mastoid external dressing applied.

The postoperative course was uneventful and the penicillin therapy which had been instituted on admission was continued. On Aug. 29, six days postoperatively, the endaural paracin gauze packing was removed and the gold foil over the facial nerve found to be intact. On Sept. 1 the pathologic report on the tissue removed from the mastoid antrum and middle ear was received from Dr. J. A. de Veer.

The report stated that the tissue was infiltrated by atypical squamous epithelium which tended to form pearls and, although relatively adult, was distinctly neoplastic. The diagnosis was squamous carcinoma of the mastoid and middle ear of low-grade malignancy.

Ophthalmologic consultation did not reveal any evidence of intracranial involvement, and neurological examination was negative. X-ray studies of the chest, base of skull, and petrous-bone apices were reported to be free of abnormality.

The patient was discharged from the hospital on Sept. 12, to be referred to the Brooklyn Cancer Institute for radiation therapy. She was examined biweekly thereafter at the Brooklyn Eye and Ear Hospital, with normal-appearing healing taking place in the cavity. There was no change in the status of the facial nerve, with the motor paralysis of the right side of the face persisting. The patient continued to complain of pain in the ear.

The patient went to Memorial Hospital in New York City but was not given radiation therapy. Intracranial complications later developed, with personality changes and speech difficulty, and the patient died Sept. 22, 1952.

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MÉNIÈRE'S SYNDROME

Further Observations on Vitamin Deficiency as Causative Factor

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IN 1949 and 1950[1] I reported in some detail the results of an investigation along nutritional lines on a series of 87 cases of Ménière's syndrome. From this investigation the following conclusions were drawn:

1. That patients with Ménière's syndrome present two distinct clinical pictures, which are readily distinguishable.

2. That many patients experience both kinds of attack and thus present a mixed clinical picture.

3. That patients can be divided by means of a histamine skin test into three groups instead of the two previously described: one in which the mechanism is primarily vasoconstrictor; another, in which the mechanism is vasodilator, and a third, an intermediate group, in which the attacks are now one, now the other.

4. That these three groups correspond to the three clinical groups mentioned.

5. That all three groups show signs of chronic severe deficiency of the vitamin B complex.

6. That the signs in the vasoconstrictor group are of a predominant nicotinic-acid deficiency.

7. That the signs in the vasodilator group are of a predominant riboflavin deficiency.

8. That the signs in the intermediate group are of a mixed deficiency of both nicotinic acid and riboflavin.

9. That all three groups show some evidence of thiamine deficiency, though this does not appear to be a determining factor.

10. That the attacks of vertigo can be controlled by administration of the appropriate vitamins in suitable dosage.

11. That tinnitus in most cases can be considerably improved and occasionally entirely relieved with the same regimen, but that deafness can only rarely be modified.

12. That on such a therapeutic regimen and with attention to dietary habits, general health is at the same time markedly improved.

CLINICAL MATERIAL

In the following four years (1948-1951) an additional 105 patients were investigated along identical lines, and those who were treated by me were treated in the same manner as those in the previous series. It will be seen that the clinical findings and therapeutic results confirm those previously described. The only addition to treatment has been that increased attention has been paid to dietary habits and to their correction when necessary.

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1. Atkinson, M.: Ménière's Syndrome: Observations on Vitamin Deficiency as the Causative Factor; I. The Vestibular Disturbance, Arch. Otolaryng. **49**:151 (Feb.) 1949; Ménière's Syndrome: Observations on Vitamin Deficiency as the Causative Factor; II. The Cochlear Disturbance, ibid. **50**:564 (Nov.) 1949; Ménière's Syndrome: Observations on Vitamin Deficiency as the Causative Factor; III. The General Disturbance, ibid. **51**:149 (Feb.) 1950.

Grouping (Table 1).—In the present series approximately half of all cases fall into the intermediate group, as before. The remainder are rather less evenly divided than in the previous series, more coming into the vasodilator (histamine-positive) group. It is possible that this finding is a matter of selection, as I suggested before. The vasoconstrictor type being easily controlled with nicotinic acid, the use of which in the treatment of Ménière's syndrome has increased greatly in the last few years, patients with this type are less frequently seen by the consultant than patients with the other two types, which are more difficult to control.

Incidence and Severity of Deficiencies (Table 2).—The findings in this series conform with those previously reported. The predominant deficiency is of nicotinic acid in the vasoconstrictor (histamine-negative) group, of riboflavin in the vasodilator (histamine-positive) group, and of the two fractions to a virtually equal degree in the intermediate group.

TABLE 1.—*Grouping of 105 Cases of Ménière's Syndrome*

Vasoconstrictor	Histamine —	Nicotinic-acid deficiency	23
Intermediate	Histamine ±	Mixed deficiency	50
Vasodilator	Histamine +	Riboflavin deficiency	32
		Total cases	105

TABLE 2.—*Deficiencies*

Cases	0	+	++	+++	++++	Total
Vasoconstrictor: histamine — (nicotinic-acid deficiency)						
Nicotinic acid	0	0	3	17	3	
Riboflavin	0	4	9	9	1	23
Thiamine	4	9	10	0	0	
Intermediate: histamine ± (mixed deficiency)						
Nicotinic acid	0	0	14	31	5	50
Riboflavin	0	2	8	31	0	1
Thiamine	4	19	22	5	0	
Vasodilator: histamine + (riboflavin deficiency)						
Nicotinic acid	0	1	15	16	0	
Riboflavin	0	0	2	19	11	32
Thiamine	2	12	17	1	0	

Clinical Findings (Table 3).—(*a*) Vertigo: It was pointed out before that the characteristic type of vertigo in the vasoconstrictor group is rotatory, in the vasodilator group is positional, and in the mixed group is of the two types, at one time one kind of attack being experienced and at another time the other type. The observation held good in this series also.

(*b*) Deafness: The point was made before that, though perceptive deafness was the commonest type in all groups, as is generally agreed, there is frequently present an element of conductive deafness (for instance, Rinne test ± or a raised lower-tone limit), with the result that many cases are of mixed type. The great majority of these fall into the intermediate or vasodilator group. Even an apparently "pure" conductive deafness is encountered at times, and this, when it does occur, has been found almost exclusively in the vasodilator, riboflavin-deficient, group. In this series the same observation was made.

(*c*) Tinnitus: The observation was also made in the earlier series that there are two types of tinnitus, one a steady continuous sound (the peanut vendor's whistle) the other a roaring throbbing sound but not synchronous with the pulse and often likened to the sound of water (ocean, waterfall); that the former seemed to be characteristic of perceptive deafness and to be associated with a predominant nicotinic-acid deficiency, while the latter seemed to be characteristic of conductive deafness and to be associated with a predominant riboflavin deficiency. These findings held for the present series also.

(*d*) Absence of Bone Conduction: This was a feature of 18 cases in the previous series and was present also in 18 cases in the present series. As before, it occurred mainly in the riboflavin-deficient and mixed-deficiency groups, only 2 of the 18 cases occurring in the nicotinic-acid-deficient group. The correctness of this observation, of absence of bone conduction with air conduction at least partially pre-

TABLE 3.—*Clinical Findings*

	Rotatory	Mixed	Positional	Total
A. Vertigo				
Vasoconstrictor (histamine —)	17	2	4	23
Intermediate (histamine ±)	9	26	15	50
Vasodilator (histamine +)	3	11	18	32
Total	29	39	37	105

	Perceptive	Mixed	Conductive	Complete	Total
B. Deafness					
Vasoconstrictor (histamine —)	16	7	0	0	23
Intermediate (histamine ±)	19	30	1	0	50
Vasodilator (histamine +)	13	9	8	2 (one post-op)	32
Total	48	46	9	2	105

	Perceptive	Mixed	Conductive	None	Total
C. Tinnitus					
Vasoconstrictor (histamine —)	19	1	1	2	23
Intermediate (histamine ±)	25	17	5	3	50
Vasodilator (histamine +)	17	0	10	5	32
Total	61	18	16	10	105

D. Absence of Bone Conduction	
Vasoconstrictor (histamine —)	2 out of 23 (9%)
Intermediate (histamine ±)	11 out of 50 (22%)
Vasodilator (histamine +)	5 out of 32 (16%)

served, has been disputed. In this series, as in the previous one, the opposite ear was carefully masked, and the observation is believed to be valid.

Patients Treated (Table 4).—The minimum length of time during which any of the 74 patients considered here has been under treatment has been six months, and most of them have been under continuous treatment for considerably more than that. Consequently, while the treatment they have received during the time they have received it has been considered adequate, it has not necessarily been sufficient. I made a point in my previous report of how long it takes to gain complete control of this condition. Therefore, in order to err, if at all, on the conservative side, a patient who has been under treatment for 12 months or less, even though he has experienced no attacks in that time, is claimed as improved, not as relieved, while patients who have been under treatment for more than 12 months and who have

been relieved of attacks but who still experience occasional moments of imbalance are also classed as improved. "Relieved" means complete and absolute relief of the particular symptom for 12 months or more as of the end of June, 1952.

Of the remaining 31 patients seen, 14 received a modicum of treatment, but for a variety of reasons it was insufficient even though in some cases successful as far as it went. They have not been included in the assessment of results. The remainder were seen in consultation and did not return or have been lost.

Results (Table 5).—Vertigo: All except two patients have been entirely relieved of their attacks or so greatly improved (4+) that they have no more major attacks. Of the other two, one lives in South Africa and since having an intensive course of treatment for a few weeks here has had to be advised by mail, a procedure which is obviously unsatisfactory. Nevertheless he is improving. The other, after an insufficient period of treatment, during which control was not obtained, decided upon operation. Three months later she reported relief of acute attacks and continuance of lesser attacks. She was one of the riboflavin-deficient group, in which, as was noted before and as is seen in this series, control is more difficult to obtain than in either of the others.

TABLE 4.—*Grouping of Treated Patients*

Vasoconstrictor	Histamine −	Nicotinic-acid deficiency	12
Intermediate	Histamine ±	Mixed deficiency	37
Vasodilator	Histamine +	Riboflavin deficiency	25
		Total cases	74

Deafness: Hearing loss was proved again to be little amenable to treatment. Damage done to nervous tissue can only seldom be undone, and then rarely completely. This statement applies to the cochlea as well as to other nervous tissue. However, when hearing is variable, when at times it is good and at other times impaired, it is usually possible to gain control so that hearing is restored to, and maintained at, its highest level. This effect has been obtained in 12 cases, of which hearing in 5 has been restored to normal, having been raised in 2 of these from a low level of some 30 db. of impairment. It will be observed that only 1 of the 12 patients is in the vascoconstrictor group; of the remainder, 5 are in the vasodilator group and 6 in the mixed group. Variability, often described as being a characteristic feature of the hearing loss in Ménière's "disease," is in fact characteristic of the predominantly riboflavin-deficient patients. Moreover, hearing loss of this type has been found to be more amenable to treatment than the steady constant deficit found in predominantly nicotinic-acid-deficient patients. This situation is in contrast to the greater difficulty of control of vertigo in the riboflavin-deficient patients.

Tinnitus: This symptom is, by its nature, more easy to control than deafness. Tinnitus is the warning signal of that disturbance of function which results ultimately in impairment of hearing. It is the cry of an ear in distress. If that cry is heeded in time, if treatment is appropriate, adequate, and prompt, then tinnitus can usually be controlled and further damage to hearing prevented, even perhaps some of it overcome. But if the cry is not heeded, or if the onset of the disturbance is

abrupt and severe, then irreparable damage may be done—it can take place in a matter of minutes—before treatment measures can be set in train. Such is uncontrollable tinnitus, irretrievable hearing loss.

As will be seen from Table 5, in this series 12 of 74 patients were completely relieved of tinnitus; 28 obtained 3+ improvement, which means that they were free from tinnitus for long periods and that it was of minor degree when present; 11 more had some degree of improvement; in 23, or 31%, tinnitus remained unchanged despite vigorous and prolonged treatment. These figures are very different from those for deafness, in regard to which 52, or 84%, obtained no improvement, and of the 5 whose hearing was restored to normal, 4 were in a very early stage, with minimal hearing disturbance.

The figures only emphasize, if emphasis be needed, the urgency of the matter once any one of this famous triad of symptoms appears. The abrupt onset, with immediate irretrievable deafness, is unusual. Much more commonly, onset and progression are gradual. Adequate and effective treatment—and there really is such a thing—at an early stage can prevent much aural disability and chronic invalidism.

TABLE 5.—*Results of Treatment*

		Relieved	Improved +++	Improved ++	Improved +	No Change	Total
Vasoconstrictor (nicotinic-acid deficiency)	Vertigo	10	2	0	0	0	
	Deafness	1	0	0	0	11	12
	Tinnitus	1	7	1	0	3	
Intermediate (mixed deficiency)	Vertigo	25	11	0	0	1	
	Deafness	2	0	3	1	31	37
	Tinnitus	8	12	6	2	9	
Vasodilator (riboflavin deficiency)	Vertigo	13	11	0	0	1	
	Deafness	2	2	1	0	20	25
	Tinnitus	3	9	2	0	11	
Totals	Vertigo	48	24	0	0	2	
	Deafness	5	2	4	1	62	74
	Tinnitus	12	28	9	2	23	

COMMENT

The findings in the present series of 105 cases confirm and extend those made in the previous series of 87 cases as regards clinical findings, grouping, and results of treatment. In both series signs of severe chronic deficiency of certain fractions of the vitamin B complex were found, and this deficiency appeared to be causative. At least, saturation of the patient with these fractions and supplementation with other fractions, together with attention to diet, has produced the results recorded. The approach, in short, has been purely nutritional. Furthermore, by these means there has been brought about an improvement in general health, an increase in energy and in sense of well-being, which has at times been startling.

The opinion was expressed in 1949 that the evidence produced then pointed to Ménière's syndrome as being the expression of a nutritional disturbance. The findings in the present series, corroborative as they are of those in the previous one, lend weight to that view, so much so that it seems justifiable now to say with some assurance that Ménière's syndrome is a syndrome of chronic nutritional deficiency.

A common criticism of this view is that such deficiency can scarcely be the case in this land of plenty. Such a comment shows that the critic is unaware of two

facts: (1) that the dietary habits of a great many people in this country in all walks of life and in all income groups are far from satisfactory and (2) that diet is only one factor in adequate nutrition, though an important one.

It is my practice now in every case to obtain a detailed record of the intake of food, fluid, alcohol, and drugs, and of the use of tobacco for seven consecutive days (and a history of dietary habits in general in the past, special dietary restrictions if any, and so on). When such a record is taken it is surprising to find how inadequate in many essentials, how ill-balanced and injudicious often is the diet even of people who might be expected to know and to do better.

Patients in the age group in which Ménière's syndrome commonly arises, 40 to 60, require a high-protein, high-vitamin, moderate-to-low-carbohydrate, and low-fat diet. It is a rarity to find such a diet, especially in these days of high food prices. Yet if patients with Ménière's syndrome are to be restored to full health and efficiency and not merely relieved of their attacks, insistence on such a diet is essential.

While on the subject of diet, it may be permissible to interpolate a word on the salt-free diet still much in vogue. However great may be its merits in such conditions as congestive heart failure or kidney disease, it would seem to have little place in the control of so exquisitely localized an edema as that of *one* labyrinth. It must have been the experience of physicians who see many cases of Ménière's syndrome, as it has been mine, to find such a diet, with or without diuretics, frequently failing to exert any influence upon either the frequency or the severity of attacks. Further, by its insipidity it can be an exciting factor in loss of appetite and a consequently diminished food intake, which, if the present thesis is correct, can only be deleterious. Indeed, I have seen more than one patient who, having adhered strictly to his physician's instructions to avoid this food and that food and all salt, has been reduced, by diminished food intake and the vomiting associated with the still-uncontrolled attacks, to a state of serious inanition. It is my firm conviction that this method of treatment, which has received such wide acceptance, is not only unavailing but may be actually harmful.

SUMMARY

The results of an investigation into a further series of 105 cases of Ménière's syndrome are presented.

The findings corroborate those obtained in a previous series of 87 cases.

The opinion previously expressed is here reiterated, that Ménière's syndrome is an expression of chronic nutritional deficiency.

The results obtained with treatment along nutritional lines support this view.

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USE OF TANTALUM IN OTOLARYNGOLOGY

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VARIOUS metals have been used in surgical procedures for many years. Silver was one of the first to be used extensively and at one time enjoyed considerable popularity. Its softness made it easy to handle but gave it the disadvantage of bending easily. Its chief fault, however, was its unfavorable tissue reaction, with resultant interference with wound healing. This fault also applied to aluminum and other metals; in fact, with few exceptions, metals are poorly tolerated in body tissues. Venable and Stuck [1] concluded from experimental work done in 1936 that all the metals commonly used in surgery were subject to electrolytic activity in body fluids and that the extent of tissue damage was roughly equivalent to the amount of galvanic reaction which took place between the metals. Venable [2] stressed the fact that a combination of two metals should never be used, even though each is itself inert. According to this author a plate of one metal should never be fastened with screws of another. Regardless of this opinion, however, tantalum plates have been fastened with stainless steel wire with no apparent ill effects.

The suitability of a metal for use in the body apparently depends on its passivity in body fluids. When a metal is passive in a fluid it means that it is so resistant to that electrolyte (fluid) that the passage of electrons is reduced to such a minimum that corrosion is practically nonexistent. The author mentioned [1] found experimentally that the three most suitable metals were Vitallium (an alloy of cobalt, chromium, and molybdenum), tantalum, and "18-8-SMO" stainless steel (an alloy of nickel, chromium, and molybdenum). Vitallium was first developed for use in dental plates but has since been extensively used for orthopedic appliances and as plates for closing skull defects. Its chief fault is that it cannot be worked cold and all appliances must be cast. This fact makes any modification at the time of operation very difficult. Stainless steel "18-8-SMO," according to Venable and Stuck,[1] shows a slow steady galvanic action in the body, and this action over a long period produces tissue irritation.

Tantalum, in contrast to Vitallium and stainless steel, is a basic element; it was discovered by Eckeberg of Sweden in 1802. Owing to difficulty in its isolation

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1. Venable, C. S., and Stuck, W. G.: General Consideration of Metals for Buried Appliances in Surgery, Internat. Abstr. Surg. **76**:297-304, 1943; in Surg., Gynec. & Obst., April 1943.

2. Venable, C. S.: Factors in the Choice of Material for Bone Plates and Screws, Surg., Gynec. & Obst. **74**:541-545 (Feb.) 1942.

it was not produced on a commercial scale until 1922. It is strong and malleable and can be drawn into wire or machined. Thin plates can be cut with ordinary strong shears, which is an advantage in the operating room. Original experimental and clinical work showed it to be inert in body tissues.

Tantalum was first used clinically by Burke [3] in 1940. He reported on the use of tantalum wire as skin sutures and also as buried sutures. It was used extensively in cranioplasty during and after the second World War. Its workability made it preferable to Vitallium for this type of surgery. Other common uses are as follows: tantalum clips for control of bleeding in neurosurgical operations, tantalum wire in the correction of deformity caused by facial paralysis, and tantalum tubes in blood vessel anastomosis. Ophthalmologists have used it in the restoration of the nasolacrimal duct and in eye muscle operations. In otolaryngology, while its most extensive use has been in frontal-sinus surgery, it has also been of value in maxillofacial surgery, rhinoplasty, laryngeal stenosis, and stenosis of the ear canal. More recently tantalum mesh has had extensive use in hernioplasty.

Other materials, however, are constantly being developed, and new materials and methods may eventually cause a diminution of the popularity enjoyed by tantalum for the past decade.

It is my intention in this paper to deal with the use of tantalum only as it affects otolaryngology. An attempt will therefore be made to appraise its value in (1) cranioplasty, with special reference to cases in which the frontal sinus is involved; (2) maintenance of postoperative nasofrontal duct by tantalum foil and tantalum tubes; (3) treatment of laryngeal stenosis; (4) maxillofacial surgery and rhinoplasty, and (5) stenosis of the ear canal.

CRANIOPLASTY

Pudenz [4] in 1943 reported successful experimental work on the use of tantalum plates for closing skull defects. In the same year Fulcher [5] reported the use of a tantalum plate for repair of a defect of the frontal bone. This defect did not apparently involve the frontal sinus. Other reports, by Robertson,[6] Kazanjian and Holmes,[7] Echols and Colclough,[8] Gardner,[9] and Woodhall and Spurling,[10] followed

3. Burke, G. L.: The Corrosion of Metals in Tissues, and an Introduction to Tantalum, Canad. M. A. J. **43**:125-128 (Aug.) 1940.

4. Pudenz, R. H.: The Repair of Cranial Defects with Tantalum: An Experimental Study, J. A. M. A. **121**:478-481 (Feb. 13) 1943.

5. Fulcher, O. H.: Tantalum as a Metallic Implant to Repair Cranial Defects: Preliminary Report, J. A. M. A. **121**:931-933 (March 20) 1943.

6. Robertson, R. C. L.: Repair of Cranial Defects with Tantalum, J. Neurosurg. **1**:227-236 (July) 1944.

7. Kazanjian, V. H., and Holmes, E. M.: Reconstruction After Radical Operation for Osteomyelitis of the Frontal Bone: Experience in 38 Cases, Surg., Gynec. & Obst. **79**:397-411 (Oct.) 1944.

8. Echols, D. H., and Colclough, J. A.: Cranioplasty with Tantalum Plate: Report of 8 Cases, Surgery **17**:304-314 (Feb.) 1945.

9. Gardner, W. J.: Closure of Defects of the Skull with Tantalum, Surg., Gynec. & Obst. **80**:303-312 (March) 1945.

10. Woodhall, B., and Spurling, R. G.: Tantalum Cranioplasty for War Wounds of the Skull, Ann. Surg. **121**:649-671 (May) 1945.

in 1944 and 1945. Conley [11] in 1944 reported the use of a tantalum implant for correction of the defect following removal of a frontal osteoma. Canfield [12] in 1945 reported favorably on its use in the repair of skull defects in the region of the frontal sinus and said it would appear that, since tantalum could be tolerated, one need not be quite so conservative in the removal of bone, because the defects could be repaired at a later date by means of tantalum. An excellent review of the history and development of cranioplasty was published by Woolf and Walker [13] in 1945. They concluded that defects up to 8 cm. in diameter may be repaired with osseous grafts. For the repair of large defects, however, they advocated the use of alloplastic grafts. They pointed out that one disadvantage of metals and alloys is that they are radiopaque, a fact which makes further x-ray studies difficult. Turner [14] in 1946 reported on its value in the repair of traumatic defects involving the periorbital structure and frontal sinus. A case of this type was also reported by Nosik [15] in 1947.

Until 1946 most reports on cranioplasty with tantalum plates were enthusiastic. It was, apparently, believed by some neurosurgeons that these plates could even be safely used in an infected field. In 1946, however, Bradford and Livingston [16] reported eight cases in which it was necessary to remove the tantalum plates because cranioplasty had been performed in the presence of infection. The subject was reviewed by White [17] in 1948 in a paper entitled "Late Complications Following Cranioplasty with Alloplastic Plates." He concludes, "It is evident that a considerable number of alloplastic plates have led to complications (151 cases to date)." Most of these complications were not serious, but in four cases in which the plates were inserted in infected fields cerebral abscess developed, resulting in two deaths. It was apparent from this review that complications from tantalum, Vitallium, and Lucite occur in practically the same proportion. In fairness to alloplastic grafts, White points out that complications may also follow the use of grafts of living bone. He recommends, however, that when the cranial defect involves the frontal sinus, grafts of living bone be used.

Lierle and Huffman [18] in 1949 reported two cases in which cancellous bone was used to repair defects involving frontal sinuses, and they conclude, "Autogenous bone is the material of choice to be used in the correction of depressed areas of the frontal bone."

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11. Conley, J. J.: Removal of Frontal Osteoma and Correction of Defect with Tantalum Implant, Arch. Otolaryng. **40**:295-298 (Oct.) 1944.

12. Canfield, N., and others: Tantalum Implants for Skull Defects, Proc. Roy. Soc. Med. **38**:293-298 (April) 1945.

13. Woolf, J. I., and Walker, A. E.: Cranioplasty: Collective Review, Internat. Abstr. Surg. **81**:1-23, 1945; in Surg., Gynec. & Obst., July 1945.

14. Turner, O. A.: Repair of Defects of Skull with Special Reference to Periorbital Structures and Frontal Sinus, Arch. Surg. **53**:312-326 (Sept.) 1946.

15. Nosik, W. A.: Tantalum Cranioplasty in Fracture of the Supraorbital Ridge and Frontal Sinus: Report of Case, Cleveland Clin. Quart. **15**:125-128 (July) 1948.

16. Bradford, F. K., and Livingston, K. E.: Failure in Early Secondary Repair of Skull Defects with Tantalum, J. Neurosurg. **3**:318-328 (July) 1946.

17. White, J. C.: Late Complications Following Cranioplasty with Alloplastic Plates, Ann. Surg. **128**:743-755 (Oct.) 1948.

18. Lierle, D. M., and Huffman, W. C.: A Simplified Method of Obliterating Frontal Bone Defects, Laryngoscope **59**:61-65 (Jan.) 1949.

Work [19] later in 1949 reported on complications following the use of alloplastic grafts in the frontal area and concluded that they were due in many cases to the fact that the frontal sinuses were not completely ablated before the grafts were inserted. He recommends complete ablation of the frontal sinuses and adequate exenteration of the ethmoid labyrinth. There should then be an interval of at least six months before the alloplastic graft is inserted. In certain cases he inserts tantalum foil between the galea and the dura to keep a line of cleavage so that subsequent dissection will not endanger the dura.

MAINTENANCE OF POSTOPERATIVE NASOFRONTAL DUCT

The methods of surgically treating the frontal sinus are numerous, and it is interesting to note that with the passage of time the number has increased rather than decreased.

Most otolaryngologists agree that no one method is applicable in all cases. This fact was emphasized in 1950 by Lyman,[20] who gave an excellent review of the literature on the subject and cited three cases illustrating different methods of surgical treatment. Since frontal sinuses are of questionable value in nasal physiology, the obliterating frontal sinus operation should be the treatment of choice. Unfortunately, however, it is usually followed by considerable deformity, the correction of which is not without danger.

In many cases, as recommended by Reeves [21] and later by Walsh,[22] the nasofrontal duct can be left intact, and certainly this procedure is physiologically sound. Split-thickness skin grafts in an attempt to form a new nasofrontal duct have been recommended by Smith,[23] Howarth,[24] and Negus.[25] Mucous-membrane flaps, as recommended by Mithoefer [26] and Sewall [27] and later by Boyden,[28] have been used for the same purpose.

Many otolaryngologists, however, believe that in certain cases some other method of maintaining a patent nasofrontal duct is advisable. Among such cases are those in which there is extensive bone destruction due to disease or previous operative

19. Work, W. P.: Paranasal Sinuses in Relation to Skull Injury: Subsequent Defects and Their Correction with Tantalum Plates, J. A. M. A. **141**:977-981 (Dec. 3) 1949.

20. Lyman, E. H.: The Place of the Obliterative Operation in Frontal Sinus Surgery, Laryngoscope **60**:407-441 (May) 1950.

21. Reeves, E.: External Radical Frontal Sinus Operation with Retention of the Original Osteum Frontale, Laryngoscope **46**:446-459 (June) 1936.

22. Walsh, T. E.: Experimental Surgery of the Frontal Sinus: The Role of the Ostium and Nasofrontal Duct in Postoperative Healing, Laryngoscope **53**:75-92 (Feb.) 1943.

23. Smith, F.: Chronic Sinus Disease: Its Present Status, J. A. M. A. **100**:402-407 (Feb. 11) 1933.

24. Howarth, W.: Some Points in Technique of the Fronto-Ethmoidal Operation, J. Laryng. & Otol. **51**:387-390 (June) 1936.

25. Negus, V. E.: The Surgical Treatment of Chronic Frontal Sinusitis, Brit. M. J. **1**:135-136 (Jan. 25) 1947.

26. Mithoefer, W.: How and When to Operate upon the Ethmoid Sinuses, Surg., Gynec. & Obst. **70**:539-542 (Feb.) 1940.

27. Sewall, E. C.: External Fronto-Ethmosphenoid Operation: New Muscosal Flap for Controlling Frontonasal Drainage and Granulation Tissue, Arch. Otolaryng. **20**:57-60 (July) 1934.

28. Boyden, G. L.: Surgical Treatment of Chronic Frontal Sinusitis, read before the 73d Annual Meeting of the American Laryngological Association, Toronto, Canada, May, 1952.

intervention. In these, some form of tube drainage appears to be indicated at least until a new nasofrontal duct is formed. A gold tube was originally used for this purpose. Ingals [29] first advocated its use as an endonasal procedure in 1905. In 1940 its use was again advocated by Anthony,[30] and it is also mentioned by Lyman.[20] The latter authors, however, recommend an external rather than the original endonasal approach. The use of such metal tubes apparently never had universal acceptance, and until the last decade a rubber tube inserted in the nasofrontal area was the commonest type of tube drainage. I have in the past left a rubber tube in the nasofrontal area for five to six weeks but always found that it became very dirty and had to be cleaned at least once weekly, frequently more often. Closure of the nasofrontal duct by scar tissue was a common occurrence, and in recent years efforts have been made to find more suitable materials for maintaining a patent opening.

Goodale [31] in 1945 advocated suturing a strip of tantalum foil to the orbital periosteum in an effort to keep it from coming in contact with the medial wall. He used this technique on eight patients and claimed satisfactory results. New and Erich [32] in 1947 found that an acrylic obturator, if properly constructed and if worn for a sufficient length of time, will avert stenosis. They recommended that this obturator should be worn for six months. Harris [33] in 1948 reported that even with careful technique and complete removal of the floor of the frontal sinus and ethmoid cells, 20% of the operations result in failure because of adhesions and closure of the nasofrontal duct. He used curved tantalum tubes with the upper end in the frontal sinus and the lower end protruding from the nostril. The tube was anchored in place by inserting a tantalum wire through its upper end. This wire was brought out through the incision and anchored to the skin of the forehead by adhesive. Harris reported three cases in which tantalum tubes were left in position for periods of five to eight weeks. The patients were free of symptoms one to three years later. No discomfort was experienced, and the tubes did not get sealed off with secretions.

Kaplan, Schwartz, and Metson [34] in 1950 reported on the use of acrylics and tantalum in cases of mucocele of the frontal and ethmoid sinuses. In cases in which the operative cavity was small, with little lateral extension, they used a curved acrylic tube, 4 to 5 cm. in length and 4 mm. in diameter, sutured to the overlying periosteum and muscle. They found that the lumen of the tube frequently became occluded by crusts and secretions and concluded that, as most of the drainage occurred around the tube rather than through it, the lumen was not necessary.

29. Ingals, E. E.: New Operation and Instruments for Draining the Frontal Sinus, Tr. Am. Laryng. Rhin. & Otol. Soc. **11**:183-189, 1905.

30. Anthony, D. H.: Use of Ingals Gold Tube in Frontal Sinus Operations, South. M. J. **33**:949-955 (Sept.) 1940.

31. Goodale, R. L.: The Use of Tantalum in Radical Frontal Sinus Surgery, Ann. Otol. Rhin. & Laryng. **54**:757-762 (Dec.) 1945.

32. New, G. B., and Erich, J. B.: An Acrylic Obturator Employed in the Repair of an Obstructed Frontonasal Duct, Arch. Otolaryng. **45**:209-214 (Feb.) 1947.

33. Harris, H. E.: The Use of Tantalum Tubes in Frontal Sinus Surgery, Cleveland Clin. Quart. **15**:129-133 (July) 1948.

34. Kaplan, S.; Schwartz, A., and Metson, B. F.: Mucocele of the Frontal and Ethmoid Sinuses: Evaluation of the Use of Acrylics and Tantalum in the Surgical Treatment, Arch. Otolaryng. **51**:172-187 (Feb.) 1950.

Originally long tubes which extended down to the floor of the nose were used. These, however, caused some irritation, and they were then shortened so that they did not reach below the superior level of the inferior turbinate. In cases in which the operative cavity extended far laterally, they used a malleable tantalum apron sewn to the orbital periosteum or to the mucocele lining, if the latter was not completely removed. One of their patients had troublesome diplopia which persisted for eight months. They therefore advised that the anterior margin of the tantalum apron be sutured posterior to the point of attachment of the trochlea of the superior oblique muscle. None of the cases reported had a long follow-up period, but the authors state, "It is intended that both the tantalum and the acrylic tube be left in place for an indefinite period, possibly permanently."

Hugenberg and Williams [35] in 1951 presented the first report indicating that tantalum can produce a foreign-body reaction in the nasofrontal area. They used a piece of tantalum foil coiled into a cylindrical tube and bent to conform to the nasofrontal duct. The upper end was flanged to keep it in place. The patient was apparently free of symptoms for two years, and then a foreign body reaction developed. On removal of the tube, however, it was found that the infundibulum-shaped frontal area had been completely covered with epithelium.

I became interested in the possible value of tantalum tubes in frontal-sinus surgery after hearing a paper (not published) on this subject by Dr. E. J. Washington, of Winnipeg, Man., Canada. This was read at the meeting of the Canadian Medical Association at Halifax, N. S., in 1950. The following five cases from the otolaryngology service of the Montreal General Hospital are presented with comments.

CASE 1.—G. D., an 87-year-old woman, was admitted to the department of ophthalmology on Jan. 6, 1950, with complaints of swelling and displacement of the right eye, watering of the right eye, and occasional right frontal headache. These symptoms had been present for approximately one year.

Examination showed a large, rather firm but slightly fluctuant swelling in the right supraorbital region displacing the eye downward and outward. A defect in the supraorbital ridge could be palpated. There were no ocular movements. Both nostrils and nasopharynx appeared clear. X-ray (Fig. 1 *A*) showed destruction of part of the roof of the right orbit. There was also a wide area of increased bone density in the right frontal area. This density extended down to include the greater wing of the sphenoid and posteriorly as far as the level of the tuberculum sellae.

The patient was transferred to the neurosurgery department, and on Jan. 20 an orbital decompression was performed. Considerable chocolate-colored gelatinous material was aspirated. Part of the lining membrane was removed, and the wound was closed. No endonasal drainage was established at that time. The immediate postoperative recovery was excellent, but the patient was admitted to the department of otolaryngology in October, 1950, because of recurrence of orbital swelling and pain. On Oct. 25, a right external frontal operation was performed. A large thick-walled cyst (mucocele) was found. This occupied the upper half of the ethmoid, part of the orbit, and all the right frontal sinus and displaced the right frontal lobe posteriorly for a distance of 1 to 2 in. (2.5 to 5 cm.). The lamina papyracea of the ethmoid, the floor, part of the anterior wall, and most of the posterior wall of the right frontal sinus were gone. About two-thirds of the cyst wall was removed. The remainder was so firmly attached to the dura that it was decided not to attempt its removal. The ethmoid was completely exenterated, and a tantalum tube about 2.5 cm. in length and 1 cm. in diameter was placed in the nasofrontal area. The upper end of this was sutured with chromic catgut to the orbital periosteum. Figure 1 *B*

35. Hugenberg, W. C., and Williams, H. L.: Use of a Tantalum Foil Tube to Maintain Patency of the Nasofrontal Duct, A. M. A. Arch. Otolaryng. **54**:167-171 (Aug.) 1951.

shows the tube in place. Figure 2 demonstrates the size of the cavity as shown by radiopaque oil. The patient was discharged on Nov. 8. The tantalum tube came out spontaneously in February, 1951. The patient died in March, 1952, from other causes without having had any recurrence of symptoms referable to her frontal sinus.

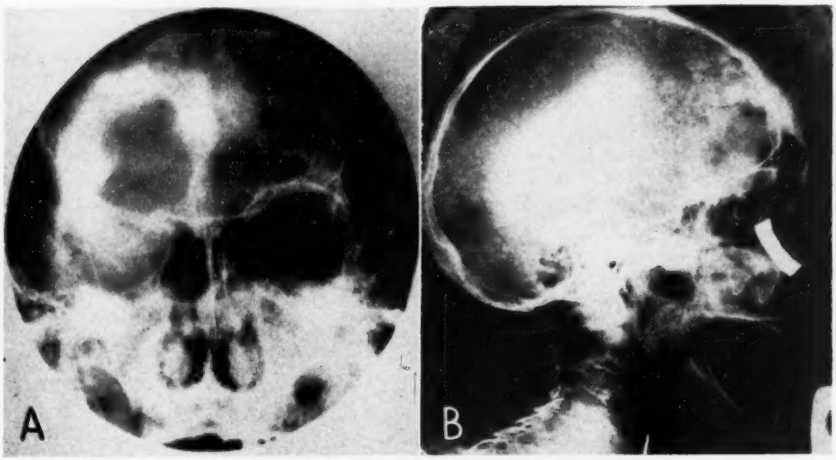

Fig. 1 (Case 1).—*A*, preoperative x-ray showing extensive bone destruction surrounded by increased density in right frontal area. *B*, postoperative x-ray showing tantalum tube.

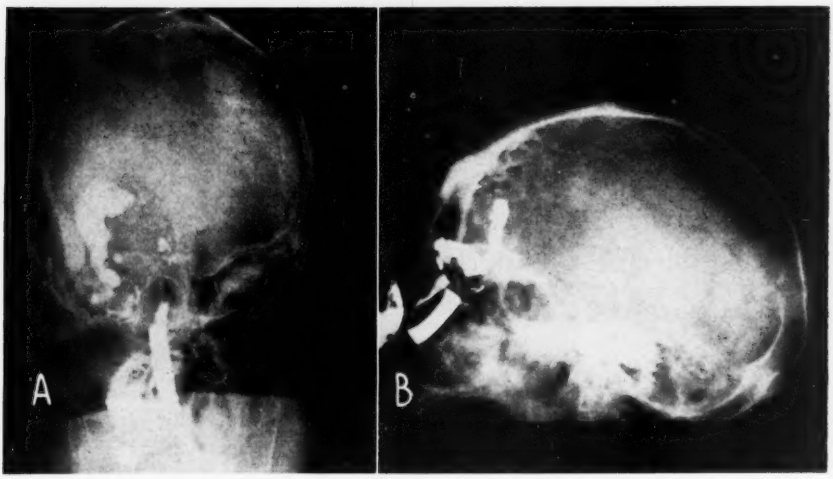

Fig. 2 (Case 1).—Postoperative x-rays with radiopaque oil showing size of cavity and extension beyond frontal sinus.

This case illustrates the extensive destruction of bone and the displacement of cranial contents which can be produced by a mucocele. The sclerosis of the bone around the frontal sinus is an example of nature's attempt to wall off the infection and obliterate the sinus. It is a sequela to chronic infection and is not infrequently

seen. The process was reported by Skillern [36] in 1936 and more recently by Volk and Mukerji.[37] The tantalum tube in this case apparently gave adequate drainage, as there was no recurrence of symptoms and presumably drainage was maintained even after the tube came out.

CASE 2.—T. H., a 62-year-old man, was first admitted in October, 1950. He gave a history of a small round swelling having developed on the right side of his forehead 15 months previously. Prior to referral to this hospital an attempt had been made to remove this swelling on the assumption that it was a cyst. A discharging fistula then developed in this area. On admission to the hospital, examination showed the discharging fistula still present in the right frontal area and a large polyp in the right nostril. X-ray examination (Fig. 3) showed marked opacity of the right antrum, ethmoid, and frontal sinuses. There was also evidence of subacute or chronic osteitis with rarefaction of bone and increased density adjacent to the right frontal sinus. Because of the patient's cardiac condition it was throught advisable to avoid radical

Fig. 3 (Case 2).—Preoperative x-ray showing rarefaction of bone of anterior wall and increased density of bone surrounding right frontal sinus.

surgery if at all possible. In an attempt to alleviate the condition a polypectomy and endonasal anterior ethmoidectomy was performed. This gave good drainage, and the fistula closed. After discharge from the hospital, however, it reopened, and he was again admitted on Jan. 1, 1951. Four days later a right external frontal operation was performed. The bone around the fistula was soft, and an area of bone about 2 cm. in diameter was removed. The mucous membrane, which was very thick, was completely removed. The floor of the frontal sinus was removed and a complete ethmoidectomy performed. A tantalum tube about 1 cm. in diameter and 3.5 cm. long was sutured in position in the nasofrontal area. Black silk was used as suture material. This tube (Fig. 4) remained in place for eight months and was then removed. The upper part of the right frontal sinus became obliterated, but there was a large nasofrontal opening into the lower part. There has been no further trouble to date.

36. Skillern, S. R.: Obliterative Frontal Sinusitis, Arch. Otolaryng. **23**:267-284 (March) 1936.

37. Volk, B. M., and Mukerji, S.: Obliterative Frontal Sinusitis: Report of a Case and Review of the Literature, A. M. A. Arch. Otolaryng. **54**:188-190 (Aug.) 1951.

This case demonstrates the futility of conservative measures in the presence of chronic osteomyelitis. The tantalum tube caused no discomfort and gave good drainage.

CASE 3.—J. A. R., a 58-year-old man, a diabetic, was admitted on Oct. 20, 1950, with the following complaints: pain in and around the left eye, protrusion of the left eye, and diplopia for

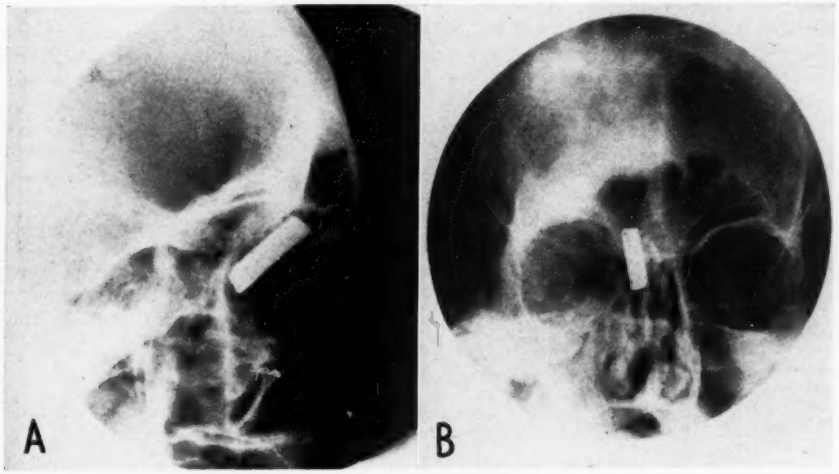

Fig. 4 (Case 2).—Postoperative x-rays showing tantalum tube.

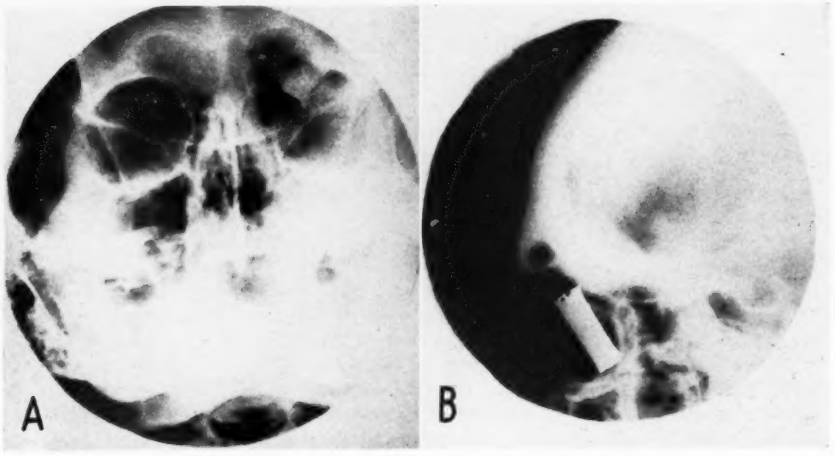

Fig. 5 (Case 3).—*A*, preoperative x-ray showing bone destruction of left supraorbital margin and sclerosis of bone lateral to this. *B*, postoperative x-ray showing tantalum tube with slight flange on upper end.

five weeks. There was a long history of sinusitis, including a left external frontal operation 20 years previously. Examination showed the left eye obviously displaced laterally and downward. There was marked deviation of the nasal septum to the left and considerable discharge in the left nostril. X-ray (Fig. 5*A*) showed an osteolytic process involving the left supraorbital

margin and sclerosis of the bone of the lateral half of the orbital margin and floor of the anterior fossa of the skull on the left. There was also cloudiness of the left antrum.

On Nov. 6 a left external frontal operation was performed. The lamina papyracea and the medial half of the floor of the left frontal sinus were gone. The medial part of the left supraorbital ridge was also destroyed. The left frontal sinus and the anterior part of the left ethmoid were filled with a large pyocele. This was completely removed. An area of dura about 1.5 cm. in diameter was exposed on the posterior wall. A slightly curved acrylic tube about 4 cm. in length and 1 cm. in diameter was sutured in position in the left nasofrontal area. The postoperative course was uneventful, and the patient was discharged on Nov. 22 for further treatment as an outpatient. The lumen of the tube quickly became blocked and treatment was difficult owing to the deviated septum. The patient still complained of discomfort in the left frontal area, and the acrylic tube was removed about one month after it had been inserted. He was again admitted in December, 1950, for submucous resection of the nasal septum, and at this time he had an adequate nasofrontal opening. After discharge, however, this opening gradually became smaller, and eventually it apparently became completely or almost completely stenosed. He was readmitted on July 17, 1951, and the left frontal sinus reopened. A tantalum tube was inserted at this time and sutured to the orbital periosteum with black silk. On the eighth postoperative day, during a prolonged bout of sneezing, the tube came out, and it was reinserted by reopening of the external incision. At this operation a slight flange was put on the upper end of the tube (Fig. 5*B*). It remained in place until April, 1952, when it came out spontaneously. The nasofrontal opening can still be easily probed, but apparently it has not completely epithelized, as there is still some bleeding when a frontal probe is passed.

This long-suffering patient seemed doomed to have everything go wrong. I tried an acrylic tube at the first operation but found that the walls were much thicker than those of the tantalum tubes and so the lumen was relatively small. In any case it quickly became blocked, and he did not appear to get the necessary drainage around it. He should have had a submucous resection of the nasal septum at the time of his first admission, but I do not think the fact that he did not had any effect on the ultimate result. One would expect an epithelized nasofrontal duct after the tube was in place for nine months, but this situation did not obtain in this case. The flange put on the upper end of the tube was of necessity rather roughly done at the time of operation, and irritation from this may have contributed to the formation of granulation tissue. If he has further trouble it would appear advisable either to leave a tube in permanently or do an obliterating operation.

CASE 4.—O. V., a 60-year-old man, was admitted on Sept. 12, 1951. He was first seen by his private physician in June, 1951, complaining of left nasal obstruction and mild frontal headache of three months' duration. The left nostril was completely filled with large polypi, which had a rather irregular appearance. This type of material was also visible in the nasopharynx. X-ray examination (Fig. 6*A*) revealed impairment of aeration of the left antrum, ethmoid, and frontal sinuses. The appearance was also suggestive of some bone destruction of the medial wall of the left antrum. A biopsy specimen taken in his physician's office was reported as showing basal-cell carcinoma, and on the strength of this report a course of radiation therapy was given. He was seen in the tumor clinic of our hospital in September, 1951, and admitted to the otolaryngology service. Further biopsy specimens were taken and reported as showing "squamous metaplasia with active hyperplasia in polypoid mucosa of the nose." Clinical appearance and x-ray findings were unchanged. On Sept. 22 a left external frontal operation, ethmoid exenteration, and left radical antrostomy were performed. All the sinuses were filled with thickened lining, polypoid material, and pus. The medial wall of the antrum, the lamina papyracea, and the floor of the left frontal sinus showed some erosion. A rather short tantalum tube, 1.5 cm. in length and about 1 cm. in diameter (Fig. 6*B*), was sutured in the left nasofrontal area in the usual manner. The patient remained free of symptoms. In November it was noted that the nasal mucosa was beginning to grow across the lower end of the tube, and in January, 1952, the tube was removed.

It does not come within the scope of this paper to comment on the original pathological diagnosis and treatment. An attempt was made in this case to use a shorter tantalum tube, but it was not entirely successful. The end-result, however, appears to be satisfactory.

CASE 5.—H. J. S., a 59-year-old man, was admitted on June 18, 1952. His complaints were swelling and displacement of the left eye for one week. Left frontal and parietal headache had

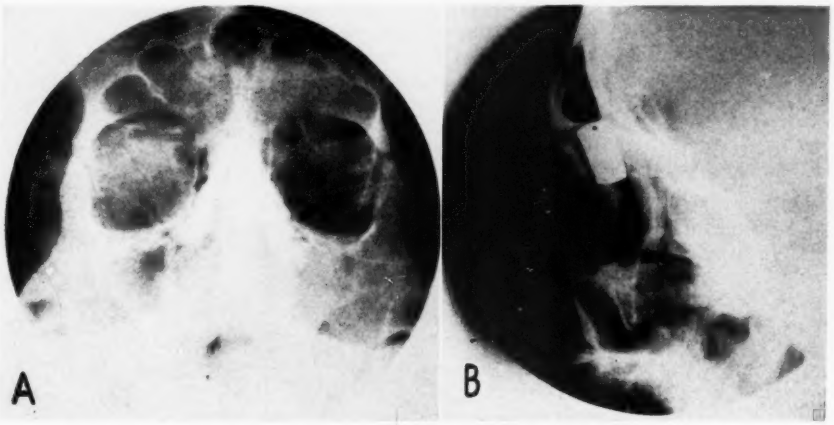

Fig. 6 (Case 4).—*A*, preoperative x-ray showing impairment of aeration of left antrum, ethmoid, and frontal sinus. *B*, postoperative x-ray showing rather short tantalum tube.

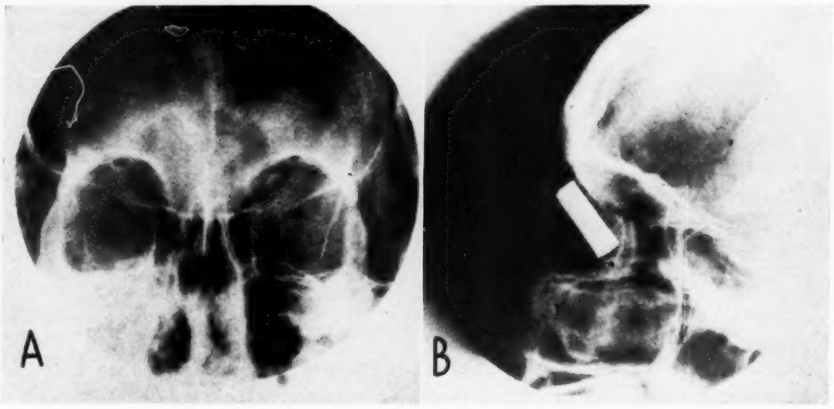

Fig. 7 (Case 5).—*A*, preoperative x-ray showing opacity of both frontal sinuses, right ethmoid, and right antrum. *B*, postoperative x-ray showing tantalum tube. Note tantalum wire anchoring lower end of tube.

been present for the past 6 to 12 months. Examination revealed a tender fluctuant swelling in the upper and outer quadrant of the left orbit with displacement of the left eye. The left eyelids were swollen and edematous. Pus was present in the right nostril but not in the left. Temperature on admission was 101 F. X-ray examination (Fig. 7 *A*) showed well-marked opacity of both frontal sinuses, right antrum, and right ethmoid. The left ethmoid showed some

evidence of infection, but this was not as marked as on the right. Conclusive evidence of osteomyelitis was not noted on this examination. On June 20 the left orbital abscess was drained. This procedure relieved the patient's discomfort, but his temperature remained elevated. On June 23 a bilateral obliterating frontal-sinus operation and left ethmoidectomy were performed. The bone of the anterior wall of both frontal sinuses was very soft. The left supraorbital ridge and floor of the left frontal sinus were also involved. The right supraorbital ridge was involved but not as extensively as that on the left. The floor of the right frontal sinus appeared healthy. The interfrontal septum was not present. Both frontal sinuses were filled with thick necrotic membrane and pus. The diseased bone was completely removed. The edges were smoothed with mastoid burrs. The floor of the left frontal sinus was completely removed. On the right side the nasofrontal duct was left intact. On the left side a tantalum tube 2.5 cm. by 8 mm. (Fig. 7 *B*) was placed in the nasofrontal area. In this case the lower end of the tube instead of the upper was anchored by means of a tantalum wire passed through a burr hole in the frontal process of the superior maxilla. The patient made an uneventful recovery.

This patient showed extensive osteomyelitis of the frontal bone with minimal symptoms until an orbital abscess developed. At the time of operation removal of the right nasofrontal duct was considered, but, in view of the fact that it appeared to be functioning and also that any small remaining space on the left side could

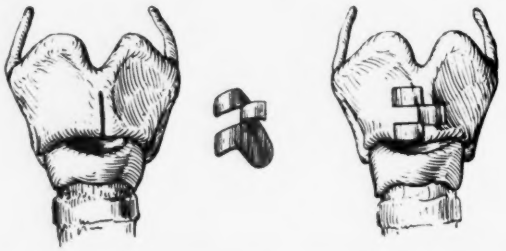

Fig. 8.—Case of laryngeal stenosis corrected with tantalum plate. (Reproduced from McNaught's article [38] with permission.)

drain through the right, the decision was not to interfere with the right nostril unless future developments dictated otherwise. A different and I think better method of anchoring the tantalum tube was used in this case. Such tubes can, of course, be anchored by making them funnel-shaped, with the large end in the frontal sinus. This procedure, however, makes removal difficult. If suturing the tube to the frontal process of the maxilla proves to be satisfactory it will be possible to remove the tube endonasally, a local anesthetic being used.

LARYNGEAL STENOSIS

In 1950 McNaught [38] described the use of a thin tantalum plate for the correction of an anterior scar-tissue web of the larynx. He quoted Iglauer [39] as having pointed out the similarity of this problem to that of syndactyly. Iglauer reasoned that if a tract could be established at the extreme angle the cords would stay apart when later separated. McNaught used this principle and described one successful case.

38. McNaught, R. C.: Surgical Correction of Anterior Web of the Larynx, Laryngoscope **60**:264-272 (March) 1950.

39. Iglauer, S.: A New Procedure for the Treatment of Web in the Larynx: Report of Case, Arch. Otolaryng. **22**:597-602 (Nov.) 1935.

A midline slot was made in the lower two-thirds of the cartilage (Fig. 8). While an associate observed the larynx via direct laryngoscopy the scar tissue between the cords was severed by passing a cataract knife through the cricothyroid membrane. A plate of tantalum 0.007 in. thick was placed in the midline slot. This was

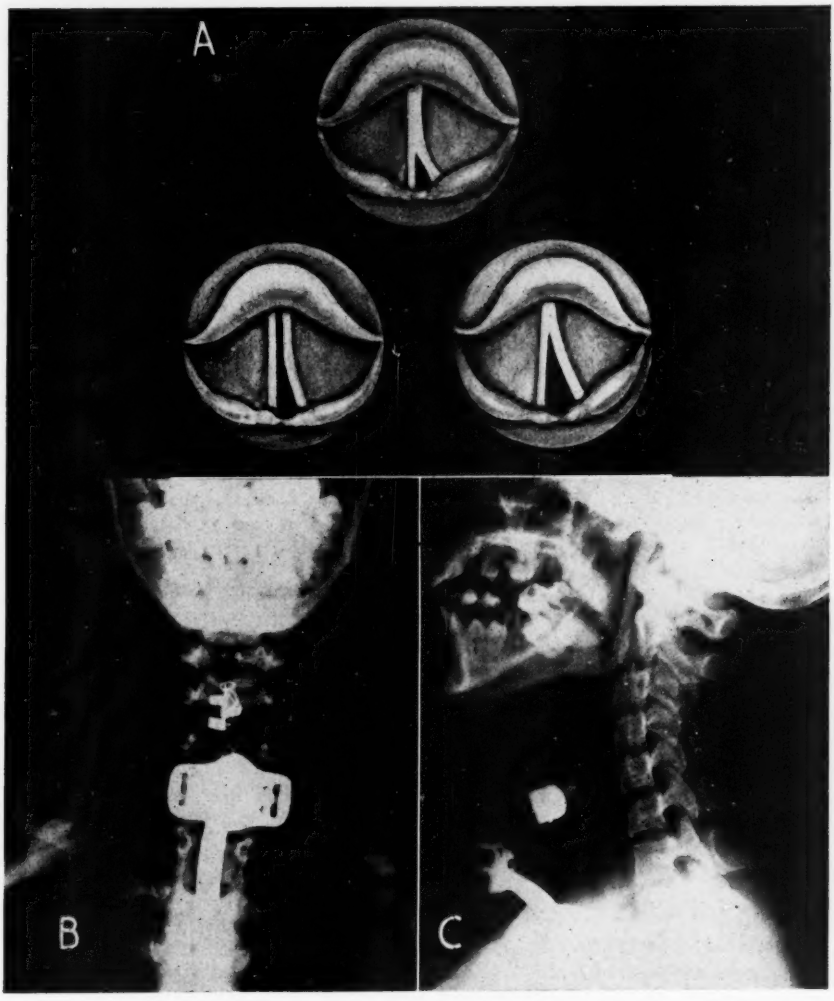

Fig. 9 (Case 6).—*A*, artist's sketch showing (I) preoperative appearance, (II) appearance one week after operation with tantalum plate in position, and (III) appearance at time of discharge from hospital. *B* and *C*, postoperative x-rays showing tantalum plate in position.

cut to such a size that it completely separated the cords but did not extend as far posteriorly as the arytenoids. The turned-down tabs prevented the plate from slipping into the larynx. The ribbon muscles were sutured together over the plate to prevent it from slipping out. It is important that the plate not be fastened to

muscles or skin, so that it can move freely with the larynx under these structures. This appliance apparently did not cause any undue reaction and was removed in two months.

This method appealed to me as being more practical, less time-consuming, and better tolerated by the patient than most of the methods previously described. I have had an opportunity to try it in one case, and the result has been gratifying.

CASE 6.—C. C., a girl aged 16 years, was admitted on March 20, 1951. She gave a history of hoarseness having developed at the age of 6 years. This was apparently due to laryngeal papillomata. The condition became progressively worse, and at the age of 11 a tracheotomy was performed. After this the papillomata were removed, and she was able to dispense with the tracheotomy tube. She was apparently well for about five years, but laryngeal obstruction again became troublesome in January, 1951. Tracheotomy was again performed two months later, and she was sent to us for further treatment.

Examination of the larynx revealed both vocal cords to be scarred. The only laryngeal airway was a small posterior chink, as seen in (Fig. 9 *A, I*). There was no movement of the right vocal cord or arytenoid. The blood Wassermann reaction was positive. She had received penicillin therapy for syphilis during the past year. There was some question as to whether she had received adequate treatment, and she was given further penicillin therapy for two to three weeks.

On April 16 a tantalum plate was inserted in a manner somewhat similar to that described by McNaught. We did a thyrotomy in this case and cut the scar tissue under direct vision after separating the thyroid alae. The tantalum palate was then sutured to the thyroid alae, tantalum wire being used (Fig. 9 *B*).

The patient wore a cork in her tracheotomy tube after operation and was discharged to her home three weeks later. She was readmitted in about one month, and the tantalum plate was removed on June 9. The laryngeal airway remained adequate, and the tracheotomy tube was removed three weeks later. She has remained hoarse, but reports from her physician state that she has had no recurrence of laryngeal obstruction.

As seen in Fig. 9*A*, III, a small anterior web developed in this case after removal of the tantalum plate. This may have been partly due to the fact that her right cord was immobile and as a result the cords were not so widely separated on respiration as they normally would be. The airway, however, is adequate, and she no longer needs a tracheotomy tube.

I realize that this method is still in the experimental stage, but it appeals to me as having advantages over the use of repeated dilatations, core molds, and so on. I have had no experience with its use in young children.

MAXILLOFACIAL SURGERY AND RHINOPLASTY

Although the use of autogenous bone grafts appears to be the method of choice for repairing defects about the face, tantalum has been used and apparently still has a place in this type of work. Bellinger[40] in 1947 presented a preliminary report on the use of tantalum in maxillofacial and oral surgery. He reported its use in 25 patients for various purposes. The uses included tantalum wire for open reduction of a fractured mandible, tantalum wool in creating and restoring facial contour and symmetry, and tantalum implant following mandibular hemisection. A tantalum sheet 0.020 in. thick was used for splinting the remaining segments of mandible

40. Bellinger, D. H.: Preliminary Report on the Use of Tantalum in Maxillofacial and Oral Surgery, J. Oral Surg. **5**:108-122 (April) 1947.

after partial resection to retain the bone segments in their anatomic position pending bone grafting. He also reported the use of a thin tantalum sheet in the closure of an oroantral fistula.

Fox [41] in 1949 reported seven cases in which tantalum-wool implants were used successfully in rhinoplastic surgery.

McClung and Chipps [42] in 1951 reported the use of tantalum foil for the closure of oroantral fistulae in four cases. Palatal and buccal flaps were raised to expose the defect in the bone of the alveolus. The flaps were sufficiently undermined for the insertion of a piece of tantalum foil about 1 in. in diameter and 0.00025 in. thick. The foil was removed in seven to nine weeks, and the authors report that the fistulae had healed deep to the tantalum implant. It is believed that the implant acted as a mechanical dam, preventing the movement of fluids through the wound during sucking, swallowing, and so on. The patients reported on were edentulous and wore their dentures over the area operated on.

Pressman in 1952 [43] reported on the use of various materials as dorsal nasal implants. In his experience the use of tantalum for closing septal defects is of limited value. Tantalum as a dorsal implant, however, may be used as a sheet metal bent to contour or as tantalum mesh.

Both Pressman and Fox made the observation that fibrous tissue grows into the mesh and gives firm fixation. In Pressman's series there were a few unsatisfactory results, due in most cases to use of too long an implant. In conclusion he states, "As experience with tantalum mesh cut to proper length grows more extensive, my enthusiasm for its use constantly increases despite the fact that it constitutes the introduction of a foreign body."

STENOSIS OF EAR CANAL

House [44] at the meeting of the American Laryngological, Rhinological and Otological Society in May, 1952, advised the use of an acrylic prosthesis as part of the postoperative treatment of congenital atresia of the ear canal. I have seen no reports on the use of tantalum for this purpose, but I have used it in one case with satisfactory results. The ear canal in the case which I shall report had become stenosed to such an extent that I thought a thin-walled tantalum tube might be used to better advantage. The stenosis, of course, might have been prevented if I had used a prosthesis early, as advised by House.

CASE 7.—R. M., a boy aged 6 years, was admitted on Feb. 12, 1952, for correction of bilateral congenital atresia of the ear canals. We operated on Feb. 16 on the right side and one week later on the left. Both ear canals became quite narrow after the operation, and he was admitted on April 30 for further surgery. Although essentially similar operations were performed on the two ears, the right ear canal again became narrow, while the left remained widely open. Because of the fact that the improvement in hearing was much better on the right than on the left it was essential that this ear canal be kept open. Attempts to dilate it were unsuccessful, and

41. Fox, S. L.: Tantalum in Rhinoplastic Surgery, Ann. Otol. Rhin. & Laryng. **58**:40-54 (March) 1949.

42. McClung, E. J., and Chipps, J. E.: Tantalum Foil Used in Closing Antro-Oral Fistulas, U. S. Armed Forces M. J. **2**:1183-1186 (Aug.) 1951.

43. Pressman, J. J.: Nasal Implants, Laryngoscope **62**:582-600 (June) 1952.

44. House, H. P.: Motion Picture: Surgical Correction of Congenital Ear Canal Atresia with Restoration of Practical Hearing, presented at the 56th Annual Meeting of the American Laryngological, Rhinological and Otological Society, Toronto, Canada, May, 1952.

by June 1 the diameter of the right ear canal measured only 4 to 5 mm. There was still a slight discharge, but regardless of this a small, thin-walled tantalum tube about 4 to 5 mm. in diameter was inserted. This tube had a narrow rim to prevent its slipping too far into the ear canal. One week later it was noted that the tube was loose in the canal. It was then replaced with one of slightly larger diameter. This procedure has been repeated on four occasions, and the patient is now wearing a tube 6 to 7 mm. in diameter. Figure 10 shows it in place, with an insert of a tube 10 mm. long and 6 mm. in diameter. The discharge stopped regardless of the presence of a foreign body, and the patient returns every three to four weeks to have it changed.

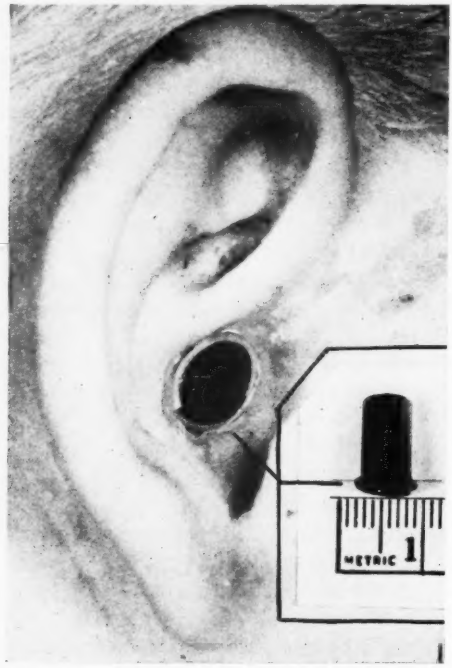

Fig. 10 (Case 7).—Six millimeter tantalum tube in right ear canal.

A properly fitted prosthesis inserted shortly after the operation would probably have prevented the stenosis in this case. In those cases, however, in which for any reason the ear canal becomes very narrow, a thin-walled tantalum tube has advantages. The lumen is wide, and I think this width was probably a factor in the cessation of the discharge in the case reported. It was interesting to note how the presence of a tube of this type not only prevented further narrowing but seemed to cause a slight gradual enlargement of the ear canal.

CONCLUSIONS

Tantalum has been used extensively in otolaryngology during the past decade and has definite advantages over other available metals and alloys.

Although autogenous bone grafts are advisable for small defects, tantalum is at present the material of choice for the repair of large defects of the skull.

Frontal sinuses should be completely ablated and ethmoid sinuses adequately exenterated before alloplastic grafts are used.

Reconstructive surgery with either alloplastic grafts or bone grafts should not be done if infection is present. There should therefore be an interval of at least six months after the original operation before any graft is inserted.

In certain cases of chronic frontal sinusitis tantalum has been found to be a useful material in maintaining a postoperative nasofrontal duct.

Although autogenous bone grafts are more extensively employed in maxillofacial surgery and in rhinoplasty, tantalum still has many advocates.

Tantalum has been used in the treatment of laryngeal stenosis and also of stenosis of the ear canal. There are not sufficient data available for the drawing of definite conclusions as to its value in treating these conditions. It does, however, show promise, and this field should be investigated further.

SUMMARY

The relative merits of various metals and alloys in surgical procedures are discussed. The literature on the use of tantalum in otolaryngology is reviewed. Cases illustrating its use in frontal-sinus surgery, laryngeal stenosis, and stenosis of the ear canal are presented. Certain conclusions are drawn as to its value.

BILATERAL ABDUCTOR PARALYSIS

A Survey of 521 Cases of Arytenoidectomy via the Open Approach as Reported by Ninety Surgeons

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SINCE THE publishing of "A Modification of the Extralaryngeal Approach to Arytenoidectomy,"[1] I have had many requests for a survey of the results obtained with this technique. In January, 1953, the following questionnaire was sent to surgeons doing such operations in the United States, Canada, Europe, and South America:

1. Number of patients operated on.
2. Number of successful decannulations.
3. Comments (voice adequate or not, complications, any remarks or suggestions).
4. Names of other surgeons known to have used this technique.

This questionnaire resulted in replies reporting 969 cases. Of these, the specific technique I described, namely "the open approach to arytenoidectomy,"[2] was used in 521.

The next most frequent operation was that described by Brian King [3] or a close modification of the King technique.[4] There were 348 cases in this group. There were 30 cases in which the Kelly [5] technique was used. These three techniques represented 899 cases of operation done via the extralaryngeal approach.

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1. Woodman, DeG.: A Modification of the Extralaryngeal Approach to Arytenoidectomy for Bilateral Abductor Paralysis, Arch. Otolaryng. **43**:63-65 (Jan.) 1946.

2. (*a*) Woodman, DeG.: The Open Approach to Arytenoidectomy for Bilateral Abductor Paralysis, with a Report of 23 Cases, Ann. Otol. Rhin. & Laryng. **57**:695-704 (Sept.) 1948; (*b*) Rehabilitation of the Larynx in Cases of Bilateral Abductor Paralysis: Open Approach to Arytenoidectomy, with Report of the Past 4 Years' Experiences, Arch. Otolaryng. **41**:91-96 (July) 1949. (*c*) Woodman, DeG., and Pollack, D.: Bilateral Abductor Paralysis: The Postoperative Care and Speech Therapy Following Arytenoidectomy, Laryngoscope **60**:832-839 (Aug.) 1950. (*d*) Woodman, DeG.: Bilateral Abductor Paralysis: Arytenoidectomy for Bilateral Abductor Paralysis; Extralaryngeal Approach, Proc. Roy. Soc. Med. **45**:821-826, (Dec.) 1952.

3. King, B. T.: A New and Function-Restoring Operation for Bilateral Abductor Cord Paralysis: Preliminary Report, Tr. Am. Laryng. A. **61**:264-296, 1939.

4. Morrison, L. F.: Further Observations on the King Operation for Bilateral Abductor Paralysis, Ann. Otol. Rhin. & Laryng. **54**:390-408 (June) 1945. Clerf, L. H.: The Surgical Treatment of Bilateral Posticus Paralysis of the Larynx, Laryngoscope **60**:142-151 (Feb.) 1950.

5. Kelly, J. D.: Surgical Treatment of Bilateral Paralysis of the Abductor Muscles, Arch. Otolaryng. **33**:293-304 (Feb.) 1941.

Thirty-five surgeons reported using the Thornell [6] transoral approach. Then operations were done via laryngofissure such as the Hoover [7] technique, submucous cordectomy, and modified Lore [8] techniques. There were 19 cordopexies,[9] all done in France, and the remaining operations were done by surgeons who had developed their own techniques, as yet unpublished.

Cases in which techniques besides my own were used undoubtedly represented only a small proportion of the number of operations done according to respective methods, inasmuch as the survey had appealed specifically to surgeons using chiefly the open approach to arytenoidectomy.

The 521 cases of the open approach to arytenoidectomy were reported by 90 surgeons, an average of 5.8 cases each. There were 61 failures, or 11.7%, with the patient unable to do without a tracheal cannula. Of the 61 failures, 21 patients had had previous lateralizing surgery by various methods without success; of these, 6 had had bilateral operations and 15 unilateral operations.

As a rule there is less than a 50% chance of being able to obtain a successful decannulation when the patient has previously been operated on. I had been able to decannulate three such patients. During the past year I was able to decannulate another by the use of a laryngofissure approach. This procedure was presented in a paper read before the American Laryngological, Rhinological and Otological Society in New Orleans in 1953 and was submitted to *Laryngoscope* for publication.[10] It should offer a much higher percentage of success in problem cases and also assure better voice rehabilitation by preserving the full adductor function of the opposite cord.

If patients having had previous lateralizing surgery with failure were eliminated, the 90 surgeons would have had a 91% average of success. It is interesting to note what one can expect from this procedure when carried out by the practiced hand. All the surgeons who had reported 10 or more cases were taken from the list of 90. There were 13 of these, with a total of 246 cases, or about 19 cases each. Their percentage of success with all cases was 91. When all their cases in which there had been previous surgery were eliminated their average of success rose to 96%.

In analyzing the failures from causes other than previous attempts at corrective surgery, it was found that there were four cases in which airways were adequate but decannulation could not be accomplished owing to definite psychosis. In four cases radiation necrosis followed treatment for cancer. There were three cases of

6. Thornell, W. C.: Intralaryngeal Approach for Arytenoidectomy in Bilateral Abductor Paralysis of the Vocal Cords: A Preliminary Report, Arch. Otolaryng. **47**:505-508 (April) 1948.

7. Hoover, W. B.: Bilateral Abductor Paralysis: Operative Treatment by Submucous Resection of the Vocal Cords, Tr. Am. Laryng. A. **53**:247-276, 1931; Arch. Otolaryng. **15**:339-355 (March) 1932.

8. Lore, J. M.: Suggested Operative Procedure for Relief of Stenosis in Double Abductor Paralysis: Anatomic Study, Ann. Otol. Rhin. & Laryng. **45**:679-686 (Sept.) 1936.

9. Moulonguet, A., and others: Rapports: Les paralysies bilaterales du larynx en adduction; leur traitement chirurgical, in Congres de 1951, Société Francaise d'oto-rhino-laryngologie, p. 39, 1951.

10. Woodman, DeG.: Laryngeal Stenosis: Corrective Plastic Procedure for Failures Following Bilateral Abductor Paralysis Surgery, Paper read before the Fifty-Seventh Annual Meeting of the American Laryngological, Rhinological, and Otological Society, New Orleans, April 28-30, 1953.

localized laryngeal tuberculosis, three cases of ankyloses of the arytenoid joint, and three cases of central lesions which prohibited decannulation. The remaining cases were classified as failures because not enough lateralization had been accomplished, and this fact was generally accounted for by incorrect placing of the suture around the vocal process, with some of the vocalis muscle included; breaking of the needle; breaking of the suture, or having a poor anchorage around which to tie the suture. There were some surgeons who had not inspected the cord with the laryngoscope before anchoring the suture, thus failing to note that when traction was applied the suture was well attached to the cord and to observe the amount of lateralization that was obtainable with traction. A check with the laryngoscope is a most important feature of the operative procedure.

Among the 521 cases there were 21 in which operation was performed without the placement of a tracheal cannula. While this feat was accomplished successfully in the great majority of these cases, I think this type of surgery holds too much risk to make it routine. One operator reported one death as a result of not placing a tracheotomy tube. A few operators had left an intratracheal tube in place 48 to 72 hours, but this procedure, too, invites cord irritation and edema, thus adding to the risks.

Comments on voice varied considerably. This is a difficult factor to analyze accurately. Only 5% of the patients were reported as having definitely poor voices. There were three reported as aphonic as a result of bilateral operative work. Of the patients, 75% were reported as having adequate voices, and the remaining 20% were said to have good-to-excellent voices. Many of the surgeons reporting stated that the voice, while adequate, was of a lower pitch.

After a review of the cases submitted, together with comments from and conversations with many of the operators, I am listing below 10 suggestions which if observed may help to minimize complications and failures.

1. In the selection of cases it is well to eliminate those in which there is localized laryngeal tuberculosis or cancer or in which considerable radiation has been given to laryngeal tissues. While ankylosis of the arytenoid is relatively rare it should be thought of and checked, as it makes a successful lateralization difficult.
2. A careful medical work-up is essential, the serum calcium, cholesterol, and phosphorus levels being noted. One should have the patient well stabilized as to the thyroid and parathyroid metabolic balance. In some of the hypoparathyroid patients tetany and psychotic symptoms developed.[11]
3. While many of these patients come to the surgeon with the tracheotomy tube already placed, if a primary tracheotomy is to be done, it is better that it be done a week or 10 days prior to any plastic operation, for the cough which accompanies the placement of a tube during the first week may help to dislodge the lateralized cord or loosen the lateralizing suture.
4. An intratracheal tube of medium size should always be placed down between the cords even though there is a tracheotomy tube in place. This procedure helps to hold the arytenoid in the field and offers some support when it comes to dissecting the arytenoid cartilage free of attachments. However, the surgeon should be sure to remove the tube before placing the lateralizing sutures.
5. Exposure of the arytenoid can often be improved by cutting across the superior cornua of the thyroid cartilage, thus giving greater mobility to the thyroid ala, permitting better rotation of the cartilage and increasing the size of the operative field.

11. Holinger, P. H.: Post-Thyroidectomy Laryngeal Paralysis (Bilateral): Medical and Surgical Aspects, South. M. J. **37**:169-175 (March) 1944.

6. As an extra assurance two lateralizing sutures should be used. I prefer an atraumatic curved sharp needle with No. 0 chromic suture.
7. Inspection should always be made with the laryngoscope after the sutures are placed but before they are anchored. This permits one to know that the suture has a hold on the vocal process and gives some idea as to how much lateralization tension is needed to obtain the desired glottic space. It is well to err by producing a wider space than needed, as the tendency is toward later retraction.
8. The surgeon should never fail to leave in a drain for two to three days. This prevents the formation of any organized hematoma.
9. If one must operate on a patient who has had previous lateralization surgery without sufficient airway, it is recommended that one operate on the same side via a laryngofissure approach, as described recently by me.[10] It is better not to operate on the other side, if an operation can possibly be avoided, in order to preserve the full adductor powers of that cord. These will be very helpful in stronger voice rehabilitation.
10. Finally, if speech therapy is available is should be utilized. I have found marked improvement in the voices of all patients who have had the advantage of such training.[1c]

Among the replies there were many whose sentiments were well summed up in the comments of two surgeons, and I quote:

In principle I feel that your operation is the operation of choice as a straightforward open single procedure with uniform good results which follows sound surgical principles.—J. B. F.

As one who has taught head and neck anatomy for some years and after watching a number of other surgeons operate for bilateral abductor paralysis, I feel the success of the operator is directly dependent on how familiar he is with anatomy and soft tissue neck surgery. It is certainly not for those who do infrequent surgical procedures in the neck.—J. H. O.

SUMMARY

I have analyzed the results of a survey of 521 cases which used the open approach to arytenoidectomy as reported by 90 surgeons.

The results of all the surgeons using this technique indicate an 88.3% chance of success. When cases were selected as to primary surgery, without previous corrective surgery, the percentage increased to 91.

Thirteen surgeons averaging 19 cases each reported successful decannulation in 91% of cases. When these surgeons selected only cases of primary surgery, their percentage of success increased to 96.

The resulting postoperative voice was reported as adequate in 75% of the cases, good to excellent in 20%, and poor in 5%.

An attempt was made to analyze the causes of failures. I have suggested a technique to use on the same side when failure occurs in order to preserve the full adductor powers of the other cord.

Ten cautions and suggestions are listed which I believe should minimize failures and assure an even better average of successful results.

156 E. 37th St.

SINUSITIS AS FOCUS OF INFECTION IN UVEITIS, KERATITIS, AND RETROBULBAR NEURITIS

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AND
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THE THEORETICAL basis for the focus of infection theory involves one or more of the following assumptions in the etiological relationship to secondary disease:

1. Toxemia.
2. (*a*) Lymphangitis with or without:
   (*b*) Bacteremia.
3. Bacterial allergy.
4. Reflex relationships.
5. In the case of the sinuses, direct extension of infection to contiguous structures.

There are many weaknesses in the theory, as clinicians have learned from practical experience.[1] Some mentioned are:

1. Assigning to the focus an etiological role in any disease that happens to coexist in the patient.
2. "Disproving" by statistics of any importance of foci by showing:
   (*a*) The presence of such foci in large groups of people otherwise in essentially normal health.
   (*b*) The highly frequent absence of cure of the supposedly secondary disease in large groups when the focus is removed.
   (*c*) The use of single-case observations to reason from the particular to the universal; i. e., the fallacy of composition.
   (*d*) Absence of genuine evidence of other than local effects of the focus, such as a demonstrable bacteriemia, or of other phenomena not readily taken care of by the body defenses.

A further vital assumption for the working of the theory is that some form of "depletion" or other conditioning factor is required to make the focus active in a given patient.

Because the sinuses are under no mechanical strain such as that put on the teeth (perhaps 150 lb., or 68 kg., of pressure on chewing), the tonsils (mechanical stress in swallowing), or the prostate (with its many stresses), they are said to be rarely indicted[1] as foci, especially in view of their self-emptying mechanisms, described by Proetz.[2]

1. Kern, R. A.: Symposium on Infectious Diseases: What Is Left of the Theory of Focal Infection? M. Clin. North America **34**:1705 (Nov.) 1950.

2. Proetz, A.: Essays on the Applied Physiology of the Nose, St. Louis, Annals Publishing Company, 1941.

Yet, in spite of all these facts, direct questioning of many of the eye surgeons at the Massachusetts Eye and Ear Infirmary was striking in four ways.

1. No surgeon denied the possibility of sinus foci in causing eye disease.
2. They considered such a relationship to be rare.
3. Chandler [3] epitomized the general opinion in his remark: "All we want is proof." His associate, Johnson,[4] immediately cited a case of nonspecific prostatic infection in which a flare-up of iritis occurred routinely after sexual intercourse; a vaccine made from a nonpathogenic prostatic-secretion saphrophyte cured the patient.
4. The impression was gained that infected teeth, tonsils, and prostates were most commonly responsible in the occasional cases recognized, but the sinuses only rarely and then usually by direct extension of infection to the orbit.

PATHOLOGICAL PHYSIOLOGY OF A SINUS FOCUS OF INFECTION

1. *"Toxemia."*—Anyone who has himself experienced an acute or subacute antral or other sinus infection in which drainage has been blocked by closure of the ostium will agree that "toxic absorption" is reflected in severe malaise, lassitude, weakness, and a generally ill feeling. The local symptoms, such as headache, and tenderness, accentuate the patient's wretchedness. Surgeons generally agree that undrained pus causes "toxic absorption."

This toxicity is a clinical entity widely recognized. It disappears almost immediately when sinus drainage occurs—not necessarily emptying of the sinuses, but merely the onset of release from pressure.

In chronic sinusitis toxemia is rarely so severe; in fact, some patients seem to tolerate chronic purulent sinusitis with little ill effect upon the general health and accept nasal and postnasal discharge or other local symptoms with equanimity. Yet in microscopic tissue-section studies of the sinus linings of such patients, one of us [5] found a localized abscess in one case in nine in which there was no question as to the presence of "undrained pus" within the stroma.

It is conjectured that tooth roots if abscessed must be more likely foci than sinuses because in chewing a pressure of 150 lb. (68 kg.) more or less is exerted on the walled-off root. Sinuses are provided physiologically with an inherent surface drainage system and are free of such mechanical stresses. If the ostium closes, however, the backing up of normal and abnormal secretions can cause much pressure. The mere presence of pus in a sinus which is chronically infected but draining so that no "back pressure" occurs is not clinically diagnostic as "toxicity."

2. *Lymphangitis and Bacteremia.*—Suppose pathogenic bacteria penetrate the sinus lining and reach the stroma. The basic inflammatory reaction there is similar to that in other parts of the body. Bacteria which escape phagocytosis locally must run the gauntlet of the retropharyngeal or the jugular chain of nodes or both before reaching the blood stream. It is well known that such nodes, as part of the reticuloendothelial system, are highly efficient barriers.

Capillary permeability which permits the basic defense reaction is greatly altered by any inflammatory processes. Normal capillaries permit the diffusion of water and other small molecules, such as sodium, chloride, and potassium, with the

3. Chandler, P.: Personal communication to the authors.

4. Johnson, C. C.: Personal communication to the authors.

5. Weille, F. L.: Asthma: The Pathology of Allergic Tissue as Seen in the Nose and in the Assessory Sinuses, Arch. Otolaryng. **12**:785 (Dec.) 1930.

greatest of ease.[6] Only moderate delay occurs with substances of higher molecular weight, such as glucose and amino acids, but for serum proteins (weight 69,000 to 500,000) capillaries are 90% to 95% efficient as retaining membranes.

The great alteration in capillary permeability which occurs with inflammation does not facilitate the passage into the blood stream of particles of bacterial dimensions.[7] But the lymphatics are readily permeable, and this fact suggests that the subepithelial membrane of a sinus, richly supplied with lymphatics, has bacteria in many cases carried to the regional lymph nodes. The filtering action of these nodes, and the phagocytic action of the cells of the sinusoids, must be recognized as very effective.

The foregoing summary epitomizes some of the present-day opinion that in acute and subacute sinusitis lymphangitis is a common development, and only rarely does bacteremia occur. Clinical experience indicates that this is the case also when a chronic focus exists, walled off by an inflammatory cellular reaction. In this situation, however, another important mechanism must be evaluated.

3. *Bacterial Allergy.*—Topley and Wilson[7] have defined bacterial allergy as a condition resulting from the introduction of bacteria or their products into the body tissues and manifesting itself as a heightened or accelerated inflammatory response to the antigen or related substance, without regard to the harm or benefit of the reaction to the host.

Experimental bacterial allergy in animals has shown that all pathogenic bacteria have the capacity to stimulate a tuberculin type of response. The invasion or injection of living organisms is followed in 8 to 14 days by a delayed response of 24 to 48 hours to a skin test of the specific bacterial substance.[8] Although most of the work done has been with the tubercle bacillus, the results are widely applicable to bacteria in general. For this reason, the tuberculin reaction becomes of great interest.

Briefly, there seems to be no doubt that certain eye tissues, particularly the uveal tract, are capable of being sensitized by bacterial infection and reacting as a "shock organ" on further exposure to the specific organism. This mechanism of action of a focus of infection seems more probable than the others which have been mentioned. Frequency of treatment with, and the effectiveness of, typhoid-vaccine therapy in the cases of iritis and iridocyclitis in the records of the Massachusetts Eye and Ear Infirmary suggest the practicality of this idea. But there is not final proof of any of the mechanisms; for example, Dunphy[9] suggests that typhoid vaccine acts favorably in uveitis by stimulating the release of cortisone through a stress reaction.

4. *Nasal Reflexes in Relation to the Eye.*—The sphenopalatine-ganglion syndrome is well known, including the fact that the ganglion has branches of distribution to the orbit and that tearing is a part of the symptom complex. Less familiar is the fact that mechanical irritation of the nasal mucosa can produce changes in caliber

6. Landis, E. M.: Capillary Permeability and the Factors Affecting the Composition of Capillary Filtrate, Ann. New York Acad. Sc. **46**:713 (Sept. 16) 1946.

7. Topley, W. W. C., and Wilson, G. S.: Topley and Wilson's Principles of Bacteriology and Immunity, Ed. 3, Baltimore, Williams & Wilkins Company, 1946, Vol. 2, p. 1331.

8. Cooke, R. A.: Allergy in Theory and Practice, Philadelphia, W. B. Saunders Company, 1947, p. 447.

9. Dunphy, E. B.: Personal communication to the authors.

of the retinal vessels on direct observation with an ophthalmoscope.[10] It is within the realm of possibility that direct reflex relationships may exist between sinusitis and the eye, particularly over the ophthalmic division of the fifth nerve and its common nerve supply to the sphenoid, ethmoid, and frontal sinuses and the orbit.

5. *Direct Extension.*—Direct extension of purulent sinus disease into the orbit obviously may cause secondary pathology there—as occasionally in proved cases of retrobulbar neuritis. (On the other hand, there have been many cases of orbital abscess in which the optic nerve was never affected.)

CLINICAL MATERIAL

Two research workers were assigned to the record room of the Massachusetts Eye and Ear Infirmary to search the files for cases of uveitis, optic neuritis, and keratitis. They tried to determine which patients had had a search made for foci

TABLE 1.—*Clinical Material: 668 Cases of Uveitis, Optic Neuritis, and Keratitis* *

	Uveitis	Optic Neuritis	Keratitis	Total
Cases	427	43	198	668
Focus hunt, no. of cases	187	38	19	244
Positive results (one or more foci)	91	10	7	108
Positive results in sinus x-rays, and other foci present	24	2	0	25
Positive results in sinus x-rays, no other foci	22	2	6	31

* From the files of the Massachusetts Eye and Ear Infirmary.

TABLE 2.—*Sinus X-Ray Findings*

	Uveitis	Optic Neuritis	Keratitis
No. of cases	187	38	19
Normal sinuses	141	34	13
Abnormal sinuses	46	4	6
	24.6%	10.5%	31.5%

of infection and more particularly for sinus pathology. Of 668 cases studied, there were 427 of uveitis, 43 of optic neuritis, and 198 of keratitis. Among 244 in which a "focus hunt" was carried out (37%), results were positive in 108 but in only 56 did sinus x-rays show slight to severe pathology. These findings are summarized in Tables 1 and 2. In order to secure long-term follow-ups and results, questionnaires were sent to all patients with positive x-ray diagnoses of sinusitis, to their physicians, or to both, when possible.

UVEITIS

Records of 427 patients having uveitis and chorioretinitis were examined. A focus hunt had been carried out in 187 cases; positive foci were found in 91. Only 22 patients had sinus pathology according to x-ray studies, while 24 others had some form of sinusitis as well as other foci. That is, only approximately 11% of the total group of 427 patients had known sinus foci. If only the 187 patients who

10. Zamorani, G.: Clinical and Experimental Contribution to the Knowledge of the Naso-retinal Reflex, Riv. oto-neuro-oftal. **24**:423 (Sept.-Oct.) 1949. Bietti: Personal communication to the authors.

had hunts for foci carried out are considered, the 46 patients with positive findings, including sinusitis with or without other foci, would equal 24.6% Sinus pathology alone as a focus existed in only 11.8%.

The degree of this pathology is important. Thus, antral cysts were present in 10 cases and only simple thickening of sinus membranes, sometimes slight, in 13 others. That is, half the 46 patients would be considered by many rhinologists to have no obvious sinus focus.

It is true that careful microscopic examination of thickened sinus linings will reveal tiny localized abscesses in approximately one case in nine. But practical rhinologists usually disregard such membranes and say flatly that no important sinus disease is present. Perhaps the great prevalence of such findings in allergic patients has been a factor in this clinical conclusion.

There are several varieties of antral cysts.[11] The majority of clinicians believe the mesothelial cyst to be unimportant and the retention cyst to be equivalent to a simple wen. Dentigerous cysts undoubtedly share in the original infection of the tooth-root abscess which results in formation of the cyst, but dentigerous cysts are of congenital origin and are therefore unlikely to act as foci. Secondary infection occurring in any cyst of the antrum may convert it into a potential focus. The records examined were such that the exact type of cyst in each case could not be determined.

Sinus Surgery.—Seven patients had sinus surgery. Table 3 summarizes somewhat superficially the salient points for this group, while Table 4 deals with the available data regarding the visual acuity of these patients.

Going more deeply into the individual cases is highly informative.

CASE 1.—The first patient in this group had recurrent attacks of iritis affecting both eyes over an eight-year period. The final visual measurement was reported as light perception only in each eye, despite nasal surgery, which included correction of the septum and radical bilateral exenteration for purulent and polypoid ethmoid and sphenoid sinusitis. The sinus operations were done one month after the onset of the iritis, which continued recurrently from that time to the present—a period of five years.

CASE 2.—Only the left eye was involved. Left chronic purulent maxillary sinusitis was treated by submucous resection of the septum and the Caldwell-Luc antral technique after the patient had had recurrent iritis for 20 years. Two years later the patient was readmitted to the infirmary with the statement that he had had recurrent attacks in the left eye for the past 22 years. A thorough study apparently never revealed an etiology. The past history was negative except to reveal "draining cervical glands 30 years ago." At the second admission, two years and four months after the nasal surgery, the sinuses were reported as normal on clinical examination, but no x-ray films were taken. He was treated for "chronic uveitis of the left eye." Use of penicillin, sulfadiazine, and typhoid vaccine resulted in "slight improvement." When a questionnaire was sent to the patient's physician in 1952 he said there had been no further attacks. That is, the iritis recurred for two years after the operation and then ceased entirely for the next five years. The claim for cure as a result of sinus surgery seems extremely doubtful, inasmuch as the patient had further attacks of iritis for two years after the antral operation, but penicillin, sulfonamide, and typhoid-vaccine therapy was followed by a "cure" over a five-year period. In the end-result 20/30 vision was measured in the affected eye, and 20/30 vision was obtained in the unaffected eye after a cataract operation.

11. Lederer, F. L.: Diseases of the Ear, Nose, and Throat: Principles and Practice of Otorhinolaryngology; Clinical Technics and Procedures, Ed. 6, Philadelphia, F. A. Davis Company, 1952, p. 599.

CASE 3.—The patient had had long-standing infectious arthritis. He was operated on because of right chronic purulent maxillary sinusitis which had persisted despite irrigation of the antrum. A Caldwell-Luc operation was done in October, 1940, with a "good result." However, two months later he began having blurred vision—the beginning of attacks of recurrent acute iritis. Ten years later the following informative note appeared in the record: "March 23, 1950: acute

TABLE 3.—*Seven Cases of Uveitis with a History of Sinus Surgery*

Eye Involved; Age at Onset	Sinus Diagnosis *	Sinus Surgical Treatment †	Sinus Result and Follow-Up	Eye Treatment	Eye Result and Follow-Up	Other Foci
Both 54	Bil. purulent and polypoid ethmoiditis and sphenoiditis	SMR; int. E. and Sph.	Improved; 2 wk.	Typhoid vaccine, penicillin	Recurrent; same, 5 yr.	None
Left 28	Chronic L. purulent antrum	L. C-L and SMR	Cured; 2 yr.	Penicillin, sulfonamides, typhoid vaccine	Unimproved, 2 yr.; cured, 5 yr.	None
Both 26	Purulent R. antrum	R. C-L	Improved; 10 yr.	Typhoid vaccine	Same; 9 yr.	None
Left 22	Bil. purulent and polypoid pansinusitis	Bil. C-L and int. E	2 yr.	Typhoid vaccine	Same; 1 yr.	Abscessed teeth removed
Left 63	Cyst L. antrum	C-L	Cured; 11 yr.	.....	Cured; 11 yr.	Infected tonsils removed
Both 40	Chr. infection R. and L. ethmoids and L. antrum	R. int., antrum and ethmoid explored; normal	Cured; 6 yr.	Cyclodiathermy	Same; 6 yr.	Infected tonsils untreated
Both 37	Pansinusitis	C-L, int. E., S., and F.	Improved; 10 yr.	Typhoid vaccine	Cured; 21 yr.	Chronic prostatitis cured

* Bil., bilateral; R., right; L., left.
† SMR, submucous resection of septum; int., intranasal; E., ethmoidectomy; S., sphenoidostomy; F., frontal sinus entered; C-L, Caldwell-Luc antrum operation.

TABLE 4.—*Visual Acuity During the Course of Uveitis in Seven Cases with a History of Sinus Surgery*

Eye Involved	Vision Approximately at Onset		Time from Onset of Uveitis to Sinus Surgery		Vision Result and Follow-Up		Uveitis Result and Follow-Up	Sinus Result and Follow-Up
	O. D.	O. S.	O. D.	O. S.	O. D.	O. S.		
Both	.....	.....	1 mo.		L. P.* 5 yr.	L. P.	Same, 5 yr.	Improved, 2 wk.
Left	.....	.....	20 yr.		20/30 27 yr.	20/30	Cured, 5 yr.; unimproved 2 yr. after sinus surgery	Cured, 2 yr.
Both	20/40	20/50	Onset 2 mo. after surgery		20/200 7 yr.	20/200	Same, 9 yr.	Improved, 10 yr.
Left	20/40	F † at 3 ft.	4 mo.		20/40 1 yr.	20/200	Same, 1 yr.	.....
Left	.....	6/20	1 mo.		20/40 11 yr.	.....	Cured, 11 yr.	11 yr.
Both	.....	.....	Months		L. P. 3 yr.	L. P.	Improved, 6 yr.	Improved, 6 yr.
Both	20/20	20/20	11 yr.		20/200 20 yr.	20/200	Cured, 21 yr.	Improved, 10 yr.

* Light perception only.
† Able to count fingers.

iritis, right eye (recurrent), associated with arthritis; sinus x-rays negative. The patient recovered from iritis and uveitis attacks with typhoid-vaccine therapy. Further nose flare-ups occurred in 1946, 1947, and 1948, with no eye difficulties. The throat service says there is 'no focus in ear, nose, or throat.'" The vision had dropped from 20/40 on the right side and 20/50 on the left side to 20/200 in both eyes without correction, but it was 20/30 with correction seven years after the onset of eye disease.

One would assume that in this patient's eye problem rheumatoid arthritis was important and the sinus disease unimportant once the iritis had become established. That the sinusitis may have had an etiological relationship to the onset of the iritis (by bacterial allergy?) cannot be excluded.

CASE 4.—A white man aged 22 had recurrent left iridocyclitis for four months. A bilateral radical antrum and intranasal-ethmoidectomy operation was done for bilateral purulent and polypoid pansinusitis after a polypectomy had failed to help the patient. The uveitis continued to recur despite this surgery, and several abscessed teeth were extracted about six months later. A few weeks after their removal, secondary glaucoma began. At the end of a year there had been no favorable effect of the focus therapy upon the condition of the left eye except that the vision had improved from seeing fingers at 3 ft. (91 cm.) to 20/200.

A nasal follow-up of two years' duration failed to yield an evaluation of the result in the sinuses good enough for determination of the end-result in the nose.

CASE 5.—A 63-year-old white woman had an antral cyst removed one month after the onset of iritis in the left eye. Secondary glaucoma developed a few weeks later, for which iridectomy was performed. She had no recurrence of her iritis over an 11-year period, and her final vision was 20/40.

A year after the nasal surgery, chronically infected tonsils were removed because of stiff joints. The joint symptoms disappeared.

CASE 6.—A 53-year-old white man in 1944 had uveitis in the right eye, with glaucoma, and during the next six years there were recurrent bouts of iritis in both eyes. Glaucoma began in the left eye in 1948. The glaucoma was chronic on both sides and persisted despite multiple operations.

One week after the patient's admission to the infirmary in December, 1944, a left intranasal antrostomy was done for purulent and polypoid maxillary sinusitis. The antral lining was only partly removed. The ethmoids, reported as infected on x-ray examination, were explored and found to be normal.

The surgery failed to improve the eye condition, since recurrent attacks of iritis continued, and the patient's vision was light perception only in both eyes.

Six years after the sinus operation the ears, nose, and throat were said to be normal.

CASE 7.—A white man aged 37, in 1929, contracted gonorrhea followed by arthritis. The same year he began to have recurrent attacks of uveitis in each eye, which persisted during the next 20 years.

In 1940 he was found to have right pansinusitis, with involvement also of the left antrum, ethmoid, and sphenoid. A bilateral radical antrum operation was carried out, as well as intranasal ethmosphenoidectomy and intranasal drainage of the right frontal sinus. This surgery failed to prevent further attacks of his uveitis. In 1947 he was readmitted to the infirmary for recurrent uveitis in the left eye. At this time a rhinologist stated in his consultation opinion that there was "no focus in the ears, nose, or throat," despite a sinus x-ray report of chronic bilateral ethmoiditis. (Sometimes the bony postoperative thickening is confusing to the roentgenologist who interprets films without a proper history of previous surgery.)

In 1949, on a third admission to the infirmary, the patient had "chronic uveitis of the right eye" and was given typhoid vaccine and injections of atropine. He was found to have normal teeth and sinuses, but chronic seminal vesiculitis. The prostatic secretion was reported to contain no gonococci, but "abundant diphtheroids, few nonhemolytic streptococci, and a few colonies of unidentified Gram-negative bacilli."

Prostatic massage, administration of sulfadiazine, and other treatment, together with the use of eye drops, resulted in complete subsidence of the uveitis during the next six months, to the time of the last entry in the record.

In reviewing the problem at the final admission it was mentioned that, in the 20 years of eye illness, "at no time has an actual etiological agent been uncovered," although pansinusitis, gonorrhea, arthritis, old healed tuberculosis at the apex of the left lung, and typhoid 32 years before had been considered. It was then that the prostatic disease was evaluated and treated in the manner described. In any event, eradication of the patient's sinusitis failed to influence the uveitis.

Among these cases, with the exception of Case 5, sinus surgery was disappointing in influencing the course of the uveitis.

Conservative treatment of the sinuses was carried out in 14 cases. In six of these, infected teeth or tonsils or both were removed. Table 5 records what

TABLE 5.—*Fourteen Cases of Chronic Sinusitis, Purulent and/or Polypoid or Cystic, Treated Conservatively* *

No. of Cases	Other Foci	Nasal Treatment	Eye Treatment	Eye Result	Eye Follow-Up
6	None	Cauterization; wash; spray; packs; polypectomy	Typhoid vaccine; penicillin; sulfonamides; collyria	Cured..... 1 Improved.. 4 Same..... 1	Average duration 3½ yr.
6	Infected teeth and/or tonsils removed	Medical: wash; spray; packs	Typhoid vaccine; penicillin; sulfonamides; cortisone	Improved.. 3 Same..... 3	Average duration 6 yr.
2	Untreated bronchiectasis; tonsillitis	Medical: drainage	Typhoid vaccine; sulfonamides; penicillin	Same..... 2	Average duration 16 yr.

TABLE 6.—*Summary of Results Regarding Uveitis Attacks in Twenty-One Cases of Treated Sinusitis*

Eye Result	Sinus Surgery	Conservative Treatment Only	Total
Same	5	6	11
Improved	1	7	8
Cured	1	1	2
Worse	0	0	0
			21 cases

TABLE 7.—*Summary of Twenty-Five Cases of Untreated Sinusitis with Uveitis*

Sinus X-Ray Report	No. of Cases	Other Foci	Eye Treatment	Eye Result	Eye Follow-Up
Thickened membrane in antrums and/or ethmoids	3	None	Typhoid vaccine; sulfonamides	Same..... 2 Improved.. 1	Average duration 3 yr.
Thickened membrane in antrums and/or ethmoids, and in frontal, 1 case	10	Foci treated and cured; teeth, tonsils, prostate	Cortisone; sulfonamides; typhoid vaccine; heat; enucleation; collyria	Same..... 4 Improved.. 4 Unknown.. 1 Worse..... 1	Average duration 7 yr.
Cyst, one or both antra	4	None	Typhoid vaccine; penicillin	Improved.. 2 Same..... 1 Worse..... 1	Average duration 10½ yr.
Cyst, one or both antra	5	Tonsils—no treatment, 2; removed 1; teeth—no treatment, 1; removed, 4	Typhoid vaccine; sulfonamides; penicillin; cauterization; x-rays	Cured..... 1 Same..... 2 Worse..... 2	Average duration 12 yr.
Bilateral polypoid ethmoiditis; decalcified ethmoid	2	None	Typhoid vaccine	Improved.. ..	Average duration 3½ yr.
Purulent left antrum	1	Tonsils removed; prostate massaged	Typhoid vaccine; sulfonamides	Same..... ..	11 yr.

happened in this group, while Table 6 compares the results of surgical and nonsurgical therapy in relation to the course of the uveitis attacks.

In 25 patients the sinus disease was untreated, although foci elsewhere were recognized and usually eradicated. Details of the sinus pathology, other treatment, and course of the uveitis are briefly summarized in Table 7. The end-results observed in the eyes are shown in Table 8.

Table 9 compares the recurrence of attacks of uveitis in patients having some form of sinus treatment with those having none.

Comment.—The foregoing results indicate that in the cases studied the surgical management of the sinusitis had little effect upon controlling the uveitis. Conservatively treated sinus disease in 14 cases was followed by a course of the uveitis more favorable than that in 7 other cases in which surgery was utilized, even though in the former such treatment was often more symptomatic than fundamental. One has the impression that the sinus pathology in many of the "treated" patients was merely coincidental to the uveitis and only rarely etiologically related to it.

Among 25 cases of untreated sinusitis, the uveitis became worse in 4. Three of the four patients had antral cysts; the other showed slight thickening in one antrum on x-ray examination. Rhinological opinion would ordinarily exclude in

TABLE 8.—*Summary of Uveitis Results in Twenty-Five Cases of Untreated Sinusitis*

Eye Result	Untreated
Same	10
Improved	9
Cured	1
Worse	4
Unknown	1
	25 cases

TABLE 9.—*Recurrence of Uveitis With and Without Sinus Treatment*

Eye Result	Sinus Surgery	Conservative Treatment Only	Untreated
Same	5	6	10
Improved	1	7	9
Cured	1	1	1
Worse	..	..	4
Unknown	0	0	1

the last patient any important probable relationship between the nasal and the eye disease. Since the only "cure" followed surgery in a patient who had an antral cyst removed, while three who did not have such cysts removed became worse, there may be some value to the patient in getting rid of this type of lesion, although 4 cases are too few upon which to base a conclusion.

Otherwise, the untreated group fared about as well as the treated group so far as the uveitis was concerned.

SINUSITIS IN KERATITIS

Among 198 patients having keratitis, the records showed that focus hunts were carried out for only 19 (9.6%), and gave positive results for 7. Of these seven patients, six had some form of sinusitis as the sole possible focus.

Three of the patients had thickened membrane in one or more sinuses; three had unilateral purulent antrums. No sinus surgery was carried out in any case, and only half the patients had nasal symptoms requiring local treatment. All were given direct treatment to the affected cornea. One patient who had ethmoidal and

antral thickening received aqueous ephedrine and penicillin nose drops; he was cured by topical medicaments to the cornea. Of the other patients, three were unimproved and two others not followed.

It was evident in studying this group of 198 cases that the ophthalmological service at the Massachusetts Eye and Ear Infirmary attached little or no importance to the presence of sinusitis in keratitis. Dunphy,[9] Chandler,[3] and Verhoeff[12] epitomized this opinion by saying that they had never seen any patient in whom such sinusitis was important.

However, the work of Castroviejo[13] has stimulated interest in the hypothesis that sinus pathology may be important etiologically, perhaps by a reflex or bacterial-allergy mechanism, in some corneal-transplant failures. He seems convinced by clinical observations that this relationship is more than merely a hypothesis, not only in the case of transplants but also in the case of certain other types of keratitis and uveitis.

Patient investigation by means of animal corneal-transplant experimentation in the laboratory, controls being used and associated efforts being made to induce sinus infection in the animals, would offer a field for stimulating and perhaps enlightening research. Castroviejo's clinical material as reported by him is such that the truth or error of his views must be appraised fairly and, if possible, conclusively. If there is a real basis for his assumptions from clinical observations, there should be a reasonable chance to obtain experimental confirmation.

Castroviejo[13] maintains that sinus treatment or surgery in many cases offers an impressive chance for saving vision or preventing actual blindness, and he implies that sinuses should sometimes be explored on the basis of ophthalmological opinion alone, even when clinical and x-ray examinations of these structures by highly trained specialists in sinus disease give negative results.

The reluctance of the rhinologist to accept the Castroviejo thesis rests upon many grounds. The human body will accept from a fellow man no other tissue than blood, bone, or cornea. It is said[9] that, while a high percentage of the corneal transplants "take," only a relatively small proportion will permanently remain uneventfully clear. A complex problem of "foreign" protein tissue tolerance arises along with a myriad of other problems, such as endothelial regeneration in the anterior chamber of the eye and fluid exchange. It is not beyond the realm of possibility that the explanation of many of Castroviejo's observations stem from the basic difficulties of making tissue transplants.

He fails to specify exactly what sinus surgery was carried out in each of his reported cases, the degree and extent of the pathology eradicated, what sinus to explore in the presence of negative results of nasal and sinus clinical and x-ray examinations, and so on. Furthermore, he seems to assume that sinus ventilation and drainage end the sinus problem and that radical surgical methods (termed "adequate") must be accepted on the chance of helping the patient's vision.

The person afflicted with potential blindness from the eye diseases under discussion may find himself upon the horns of a dilemma in having to consider the

12. Verhoeff, F. H.: Personal communication to the authors.

13. Castroviejo, R.: Symposium on Ocular Allergy: Cornea and Lens, Tr. Am. Acad. Ophth. **56**:242 (March-April) 1952; Role of Foci of Infection in the Nasal Accessory Sinuses to Eye Diseases, read before the New York Academy of Medicine, New York, Nov. 19, 1952.

threat of visual impairment or the acceptance of the many risks, possible complications, and other drawbacks of perhaps extensive and serious sinus surgery.

We believe that great caution must be exercised by rhinologists in this situation. They must demand:

1. Convincing evidence of necessity on the basis of the nasal and sinus pathology that sinus surgical intervention is desirable.
2. Avoidance of drastic methods in minor sinus involvement.
3. That the patient, ophthalmologist, and rhinologist all understand prior to operation the controversial nature of such surgery in relation to the possible benefit or lack of benefit to the eye condition.
4. That ophthalmologists realize the high degree of accuracy of competent rhinological clinical, laboratory, and x-ray examinations in the diagnosis of sinusitis.

It is of course possible that simple trauma to nasal structures, or the inflammation so induced, totally aside from the focus of infection theory, may explain some of the favorable eye changes observed by Castroviejo. In any event, his work must be confirmed by others before rhinologists permit enthusiasm to outweigh judgment.

RETROBULBAR AND OPTIC NEURITIS

The relationship of sinusitis to retrobulbar and optic neuritis has been exhaustively reviewed in medical literature, and detailed descriptions can be found easily.[14]

In retrobulbar neuritis the anatomical relationship of the sphenoid and posterior ethmoid cells to the optic nerve has received much attention, since direct extension of sinus inflammation to the nerve trunk must be considered. In order to find out directly how often there is likely to be a dehiscence of the bone of a posterior ethmoid cell in near contiguity to the optic nerve, one of us examined 171 skull specimens at the Harvard Medical School; he found only two such dehiscences. In 29 of the ethmoids the labyrinth was exenterated in such manner as to make certain whether or not the optic nerve actually passed through, or lay free within, a posterior ethmoid cell. No such finding could be made in this series.

Of 50 sphenoid sinuses, dehiscences were found near the optic nerve in 2 and near the lateral extremity of the optic chiasm in 2 others (both in the same skull).

The importance of such dehiscences obviously is the possibility of easy, direct extension of sinus infection to the optic nerve—presumably in about 1% of ethmoiditis and 8% of sphenoidal inflammations. That this is an infrequent occurrence must be obvious from the wide prevalence of such sinusitis and the rarity of retrobulbar neuritis, in the presence of which the sinuses are usually normal.

Among 43 cases of retrobulbar neuritis studied in the records of the Massachusetts Eye and Ear Infirmary, hunts for foci had been carried out in 38. In 10 results were positive. Only four patients had demonstrable sinusitis—two with and two without other foci. According to Guyton and Woods,[15] 507 patients with cataracts, ocular trauma, and other ocular pathology were studied as a control group to find the expected incidence of foci of infection in presumably otherwise normal persons. The incidence in this group was 13%. In the present group it was 10.5%.

14. Berens, C., Editor: The Eye and Its Diseases, Ed. 2, Philadelphia, W. B. Saunders Company, 1949. Lederer.[11]

15. Guyton, J. S., and Woods, Alan C.: Etiology of Uveitis: A Clinical Study of 562 Cases, Arch. Ophth. **26**:983 (Dec.) 1941.

One patient with bilateral chronic ethmoiditis and another with an antral cyst had abscessed teeth extracted. The latter also had sulfadiazine therapy and appeared cured in a 10-year follow-up, with final vision of 20/30 in the right eye and 20/40 in the left in contrast to 20/70 in the right eye and 20/200 in the left at the onset. The former patient was unimproved over a one-year period. The sinusitis was untreated. A third patient, with retrobulbar neuritis, an untreated cyst in the right antrum, and right ethmoiditis, had no follow-up.

The fourth patient had bilateral pansinusitis for which a bilateral Caldwell-Luc antrum operation was done prior to admission to the infirmary. Osteomyelitis of the right upper jaw supervened, with direct extension of streptococcal infection to the orbit, resulting in an orbital abscess and retrobulbar neuritis. The patient died one week later of meningitis and septicemia.

SUMMARY AND CONCLUSIONS

Uveitis.—If the sinusitis is such as to require treatment upon its own merits, whatever management is indicated, whether medical or surgical, should be carried out. The attempt to eradicate sinus pathology in order to cure uveitis may be undertaken if the rhinologist, the ophthalmologist, and the patient all understand clearly that such therapy only occasionally is useful so far as the eye disease is concerned.

Keratitis.—Controversy rages regarding the importance of sinusitis in keratitis, especially in that complicating corneal transplants. Ophthalmological surgeons at the Massachusetts Eye and Ear Infirmary are skeptical of any basic relationship.

Retrobulbar Neuritis.—Dehiscences in posterior ethmoid cell walls in close relationship to the optic nerve are common. Posterior ethmoiditis is extremely common in clinical practice, but its association with retrobulbar neuritis is rare.

This is true also of sphenoiditis, although sphenoidal dehiscences in relation to the optic nerve and optic chiasm are frequent.

Of 38 cases of retrobulbar neuritis in which hunts for foci were carried out, sinusitis could be found in only 4, and in 1 it was an obvious cause of retrobulbar neuritis incidental to massive infection, which caused death within one week.

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SUGAR AND CHLORIDE IN FLUID FROM INTRANASAL CYSTS

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IN 1941, Eichelberger and Lindsay [1] reported findings with regard to the chemical composition of fluid contained in intranasal cysts; Lindsay [2] again reported on this subject in 1942. These authors found relatively large amounts of sugar and chloride in this fluid. Such determinations had not been reported previously. Their findings came to light during recent treatment of a patient at the Mayo Clinic.

REPORT OF A CASE

An 18-year-old girl had had myxomatous polyps removed from the left nasal chamber on four previous occasions, two years and one year prior to the present visit. A large cyst-like structure was seen on anterior rhinoscopy; it arose high in the left nasal vault and filled the left nasal chamber. It also could be seen projecting through the left choana into the nasopharynx.

The question of encephalocele or meningocele arose; therefore the contents of the cyst were aspirated. Yellow fluid, which clotted readily, was obtained. The value for sugar in this fluid was 88 mg. per 100 cc.; because of insufficient fluid, chlorides could not be determined. It was the impression of a number of consultants that this material represented cerebrospinal fluid. Roentgenograms of the paranasal sinuses and the head revealed diffuse clouding of the sinuses on the left, including the frontal, with some extension into the right frontal sinus; however, no discrete break could be demonstrated in the region of the cribriform plate.

The contents of the cyst were aspirated again, and a generous specimen of the lesion was sent for biopsy. The pathologist reported the presence of inflammatory myxomatous tissue. The value for sugar was 100 mg. per 100 cc. of fluid, and that for sodium chloride was 619 mg.

Decision was made to remove the cyst intranasally, repairing any intracranial defect at a later date if cerebrospinal rhinorrhea developed, as was fully expected. The cyst was removed with the aid of local anesthesia on Oct. 13, 1952. The stalk was seen to come from the left nasofrontal duct, which was large and could be probed readily with a suction tip. No more yellow fluid drained after removal of the cystic mass. A probe could be passed from the left frontal sinus into the right frontal sinus through a patent septum.

The postoperative convalescence was uneventful, with no further drainage of fluid. On two occasions, one and two weeks postoperatively, the patient complained of moderately severe left frontal pain; this was relieved by passage of a suction tip into the left nasofrontal duct, with subsequent rupture of the sealed-over wall of the cyst. Immediate relief of the pain was produced on discharge of the retained cystic fluid. Postoperative roentgenograms of the sinuses revealed pronounced clearing of the cloudiness in the right and left frontal sinuses, which was attributed to the collapse of the walls of the cyst.

From the Section of Otolaryngology and Rhinology, Mayo Clinic.

Read before the Minnesota Academy of Ophthalmology and Otolaryngology, Rochester, Minn., April 10, 1953.

1. Eichelberger, L., and Lindsay, J. R.: Chemical Composition of Fluids from Benign Cysts of Antrum, Proc. Soc. Exper. Biol. & Med. **48**:191-195 (Oct.) 1941.

2. Lindsay, J. R.: Nonsecreting Cysts of the Maxillary Sinus Mucosa, Laryngoscope **52**:84-100 (Feb.) 1942.

RESULTS IN OTHER CASES

Since the results of determinations of sugar and chloride in this patient's cystic fluid had been somewhat surprising, it was considered worth while to study additional cases. Fluid was obtained from intranasal cysts either at the time of antral puncture and lavage or directly by aspiration at the time of a Caldwell-Luc operation in the next six cases encountered. In every instance, the fluid was yellow, clotted readily on standing, and contained from 60 to 103 mg. of sugar per 100 cc. and from 617 to 742 mg. of chloride, as shown in the accompanying table. The chloride was determined as milligrams of sodium chloride per 100 cc. of fluid. These determinations were carried out as routine procedures in the laboratory of biochemistry at the clinic. Values for sugar were determined according to the method of Folin and Wu and those for sodium chloride by the Osterberg-Schmidt method.

COMMENT

Lindsay considered that such fluid was more characteristic of an exudate than a transudate, because it contained a relatively large amount of protein, because its

Values for Sugar and Sodium Chloride (Milligrams per 100 cc.) in Normal Blood and Cerebro-Spinal Fluid and in Fluid Aspirated from Intranasal Cysts

Material	Sugar	Sodium Chloride
Blood (Normal Range)	70 to 120	560 to 630
Cerebrospinal Fluid (Normal Range)	45 to 80	720 to 750
Fluid from intranasal cysts		
1	100	619
2	103	617
3	83	635
4	66	638
5	74	729
6	60	742
7	74	626

specific gravity was more than 1.015, and because of the ease with which it coagulated. The fibrin present in the fluid is the reason for its characteristic ease of coagulation. The yellow color is produced by blood pigments.

Cerebrospinal fluid is clear and does not clot; these two features allow differentiation from intranasal cystic fluid. When cerebrospinal fluid is examined chemically, the amount of sugar should be less and the amount of chloride generally greater than the amounts of fluid removed from intranasal cysts.

The occasional spontaneous rupture of an intranasal cyst, with resulting discharge of varying amounts of fluid, should not be misinterpreted if this fluid is examined for its content of sugar and chloride and if the physician is aware that the presence of moderate amounts of sugar and chloride does not necessarily indicate that such fluid represents cerebrospinal fluid.

SUMMARY

A study was made of fluid aspirated from intranasal cysts in seven cases. Appreciable amounts of sugar and chlorides were present in this fluid in all seven cases.

An impression that the presence of sugar and chloride in appreciable amounts in fluid from intranasal cysts indicates cerebrospinal fluid is incorrect if consideration is given to other properties of this fluid.

SEPTOPLASTY FOR CORRECTION OF DEVIATION OF NASAL SEPTUM

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THE EARLY frequent use of antibiotics and chemical therapy in treating acute sinusitis and colds has lessened the production of chronic sinus infection and is reducing the necessity for sinus surgery. Also, a better understanding of vasomotor rhinitis and nasal allergy has resulted in a lessening of the formation of nasal polyps. However, the deviated nasal septum is still a major surgical problem in intranasal therapy. Deviations of the septum frequently prevent normal ventilation and drainage of the nasal sinuses. They are also a major cause of impaired breathing.

In properly selected cases removal of obstructions caused by the septum is all that is necessary to establish ventilation and drainage of the sinuses to effect a cure in a natural way.

Deviations of the septum are a frequent but not the sole cause of impaired nasal breathing. Each case has to be carefully studied to decide whether the impairment is obstructional or functional or both. If there is an obstructional element it is important to evaluate the extent to which it contributes to the impairment of breathing.

Almost every person has a septum which is deviated to some degree from the midline. This deviation may be either congenital or traumatic. It is only when the septum causes symptoms that the physician has to concern himself with it.

In recent years there has been a tendency to combine rhinoplasty with correction of the septum as one surgical procedure. From my experiences and observations I believe better results can be obtained by doing two separate operations. Obviously the correction of a deviated septum for sinusitis and a cosmetic rhinoplasty should never be undertaken at the same time. When the septum is a cause of impaired breathing, or when it affects the nasal contour, it is usually advisable to correct it first and do the cosmetic operation later. This procedure is especially important when the cartilaginous septum is chiefly involved. Deviations of the bony septum usually present no problem and may be corrected during the plastic operation. The perpendicular plate can often be restored to the midline by instrumental or manual fracture.

After a rhinoplasty in which a new nasal arch has been created, the patient occasionally experiences difficulty in nasal breathing. Bearing in mind the path the inspired air takes, upward to the olfactory area and the roof of the nose, thence being deflected downward, one can understand the cause of this difficulty. The air travels up, passing through a sulcus between the septum and the upper lateral cartilages. When the latter are severed from the septum, trimmed, and restored to their former position, the sulcus is gone, the nose narrowed, and their mobility diminished. This

situation may result in impaired nasal breathing. The importance of the upper lateral cartilages in breathing is readily demonstrated by gently applying one's fingers to the nose over them. Breathing at once becomes difficult. It is well to bear this in mind when planning a septum operation to improve breathing which has become impaired after a rhinoplasty.

CORRECTION OF THE DEVIATED SEPTUM

Deflections involving the bony septum, and spurs and ridges usually present no problem. In this article I am chiefly concerned with malpositions of the cartilage, congenital or traumatic.

The conventional submucous resection of the septum is exactly what the name implies, removal of cartilage and bone between the elevated membranes, which are then approximated. This method of correcting a deviated septum has several drawbacks. The initial incision is made over cartilage at a varying distance from its extreme edge. It leaves a buttress, which may be obstructive and undesirable. Furthermore, if there is a subluxation of the cartilage protruding into the vestibule, no improvement can be expected from the conventional incisions, which leave this part still protruding. Often too much dorsal cartilage is left for fear of causing a saddle depression over the dorsum. This factor alone may cause a poor result. Another distressing aftermath may be flaccidity of the septum, causing it to sway with breathing.

The following technique, which I prefer to label septoplasty (instead of submucous resection), has been found in my experience to be an efficacious means of avoiding the pitfalls mentioned.

The healthier the mucous membranes are, the more likely is the surgeon to obtain good results. This is especially true in cases in which the chief complaint is impaired breathing. If there is dryness or some atrophy of the mucosa a careful appraisal should be made to decide whether the difficulty is functional rather than a mechanical obstruction. Many patients are seen with deviated septums who have ample nasal cavities yet complain of nasal obstruction. It is possible that their mucosa is atrophic and cannot receive the stimuli necessary to stimulate reflexly the muscles of respiration. Operating on this type of patient not only will not improve the condition but may worsen it.

In patients who have a perfectly straight, well-placed septal cartilage, particularly at the lower margin, a routine submucous-resection incision may be made, a cartilaginous strip being left. In all other cases, I make my initial incision along the entire margin of the septal cartilage, usually on the left side. This is brought into view by pushing a finger on the junction of the cartilage and the membranous septum on the opposite side. In cases in which there is subluxation, the marginal edge is readily seen in either vestibule. Through this incision the mucoperichondrium is elevated on each side of the cartilage. Care should be taken not to go through the membrane on the side opposite the original incision. I prefer whenever possible to elevate the membrane on each side completely before removing cartilage and bone. The initial incision may be carried down over bone to the floor of the nose. If there is no obstruction there I do not disturb it. If the perpendicular plate is merely deflected to one side, it can be restored to midline by manipulation with a fracture forceps. In this situation I separate the mucoperiosteum on one

side only, leaving the membrane on the opposite side adherent to the bone. In all other situations I completely free the cartilaginous and bony septum from its membranes. With a swivel knife I remove the entire septal cartilage with the exception of a rim along the dorsum. The bone is next removed if necessary. The spine and crest are removed by chisel. The flaps are now brought together and a survey made to determine whether more dorsal cartilage should be removed. In many cases results are unsatisfactory because of timidity in removing this cartilage. It should be removed in sufficient amounts and thinned or cross-hatched to give the desired result after repeated checking with the flaps brought together. Whether or not the dorsal profile is maintained by the lateral cartilages or the septal cartilage, the fact remains that unless support is given the septum after a radical removal of the septal cartilage, saddling will occur. This is true especially in those cases in which the lower septal margins of the upper lateral cartilages do not extend completely down to the lower lateral cartilages, leaving a gap on the septum between the upper and lower lateral cartilages. When such an anatomically weak point exists, removing the septal cartilage often results in a saddle depression. I prevent such a depression by reintroducing either the removed or the preserved cartilage. If the removed septal cartilage is not too distorted, it can be trimmed and replaced in one piece. If it is twisted or bent, it may be necessary to reinsert it in two or more pieces. It is placed between the flaps and held in position at the lower cut border of the membrane at the original incision. A mattress suture through the membranes and cartilage will hold it in place. When more than one piece of cartilage is used the nose should be packed with petrolatum gauze before the insertion. It is advisable to use one of the pieces of cartilage at the lower border, and this may be sutured in place after the other pieces have been inserted.

Next, the margins of the original incision are sutured together with several atraumatic sutures. Care must be taken not to cause a distortion or retraction of the columella.

In some cases it may be necessary to implant a cartilage graft into the columella to prevent retraction and give added support. A pocket is created, and a small graft of the septal cartilage or preserved cartilage is inserted and held in place by sutures passed behind it. The incision is made as far forward as possible, care being taken to leave the membranous septum intact. This step may be done before or after the septal graft is inserted.

It is advisable to leave the membranous septum untouched if possible, as removal or contraction of it may result in a rigid nose or one that is shortened and thickened. This possibility is the objection to straightening the septum through a transfixion. In this method it is often necessary to shave off a slice from the cut margin in order to visualize the membranes which are to be elevated. This step plus the normal contracture that takes place in healing may shorten the nose, creating a pushed up or pudgy appearance. Shortening of the nose should not be done unless the dorsal skin is separated and the lateral cartilages treated, as in a rhinoplasty.

If the opposite membrane is accidentally torn during the separation, a perforation will not result if the cartilage graft is held in place opposite it.

The nose is completely packed with petrolatum gauze, which is kept in place for at least two days. The sutures are removed on the fifth day.

COMMENT

The nose must be carefully studied to determine whether an operation on the septum will improve the breathing and facilitate natural ventilation and drainage of the sinuses.

In cases in which there are external nasal deformities it is advisable to do a two-stage operation, first correcting the deviated septum and later completing the rhinoplasty.

To prevent saddling of the dorsum and flapping or ballooning of the septum (which may occur after a conventional submucous resection) the removed cartilage or preserved cartilage should be reinserted. This procedure also allows a more generous removal of the septal cartilage.

The bony septum usually presents no problem and may be removed or fractured.

The membranous septum should be preserved as completely as possible in order to retain the flexibility of the anterior part of the nose.

The term septoplasty, rather than submucous resection, is suggested to describe the reconstruction of the deviated septum.

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EFFECT OF CHROMATES ON NOSE, THROAT, AND EAR

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THIS PAPER is being presented as a thorough ear, nose, and throat survey on 100 persons who were picked at random from a chromate plant in eastern Ohio. The study was carried out at the Cleveland Clinic Foundation under the auspices of Dr. T. F. Mancuso, Department of Industrial Hygiene, Ohio State Board of Health.

HISTORY

Cummings [1] first described "chrome holes" in 1827. Hamilton [2] says that Becourt and Chevalier in 1851 described a new skin disease due to chrome without apparent knowledge of Cummings' paper.

In 1854 Heathcote [3] described an obstinate ulceration of the tonsils and pharynx in a bichromate-factory worker. Legge in 1902 [4] stated that no such extensive ulceration had been observed since. However, Wutzdorff [5] noted slight ulceration of the gums and pharynx.

Legge was the first to write a complete description, including pathology and order of occurrence of symptoms, of the effects of chromates on the nose. He observed 71.6% of 176 workers to have septal perforation and found an additional 17% to have ulceration of the septum.

Lehmann [6] made the first approach to the problem in the light of present-day industrial hygiene when he found that 8 mg. of chromate per 1,000 liters of air was sufficient to produce a caustic effect on the nasal mucous membranes of cats. Death due to pulmonary lesions occurred in these experimental animals when they were

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1. Cummings, W.: Remarks on the Medicinal Properties of Madar, and on the Effects of Bichromate of Potassium on the Human Body, M. & Surg. J. **26**:134, 1827.

2. Hamilton, A.: Industrial Poisons in the United States, New York, The Macmillan Company, 1925, pp. 319-322.

3. Heathcote, G.: A Case Showing Poisonous Effects of Bichromate of Potash, Lancet **1**:152, 1854.

4. Legge, T. M., in Oliver's Dangerous Trades, London, E. P. Dutton & Co., Inc., 1902, p. 447.

5. Wutzdorff: Die in Chromatfabriken beobachteten Gesundheitsschädigungen und die zur Verhütung derselben erfordlichen Massnahmen, Arb. kaiserlich. Gsundhtsamte. **13**:328-335, 1897.

6. Lehmann, K. B.: Die Bedeutung der Chromate für die Gesundheit der Arbeiter, Zentralbl. Gewerbehyg. **2**:193-195, 1914.

subjected to this concentration three hours a day for five days. However, he stated that, in a thorough study of chromates in German industry, the poisoning effect was usually found to be local rather than systemic.

Lieberman [7] examined five patients who worked in a chromium-plating plant and noted septal ulceration in all. In one complete septal perforation was present. He quotes Ranelletti [8] as saying that of 69 workers in an Italian chemical plant where potassium bichromate was used in large quantities, half had ulceration of the nasal mucosa and 6 had complete septal perforation.

Card [9] reported one case of asthma sensitivity to chromates after five months of exposure. He was able to elicit a similar response by injection of 0.004 grain of potassium dichromate intradermally. This response, as well as the original asthmatic attack, was relieved by the administration of epinephrine. Examination of the nose and throat was reported as having normal results. No ulceration of the nose was noted, although some crusting was present. Legge quotes Delpech and Hillairet as finding asthma in a chromate worker; however, there was a family predisposition toward the disease.

Carter [10] reported one case in which there were minute ulcerations on the soft palate as indicated by pinpoint yellowish spots which could not be brushed off with a cotton applicator. In addition, the epiglottis was swollen, and the vocal cords were pink and somewhat thickened. Examination of the nose showed intense congestion of the mucous membrane and a small oval ulcer on the left side of the cartilaginous septum, which had not yet perforated.

PATHOLOGY

Bloomfield and Blum [11] reiterate Legge's statement that in no instance is the anterior part of the lower border of the septum destroyed and that the bone is never attacked by the process of necrosis. Consequently, the rigidity of the septum is always maintained, and nasal deformity is absent.

Legge, in accounting for this statement, says that limitation of the perforation to the cartilage of the septum is due to the fact that the mucous membrane covering it is adherent, overlying the perichondrium, and is far less vascular than the mucous membrane lining the remainder of the nasal fossa. Once the mucous membrane is destroyed, the blood supply to the cartilage is cut off and necrosis ensues. The ulceration, having progressed upward as far as the junction of the quadrilateral

7. Lieberman, H.: Chrome Ulceration of the Nose and Throat, New England J. Med. **225**: 132-133, 1941.

8. Ranelletti, A.: L'ulcerazione e perforazione del setto nasale da chromo e chromati, Policlinico (sez. prat) **26**:1057-1060, 1919.

9. Card, W. I.: A Case of Asthma Sensitivity to Chromates, Lancet **2**:1348-1349, 1935.

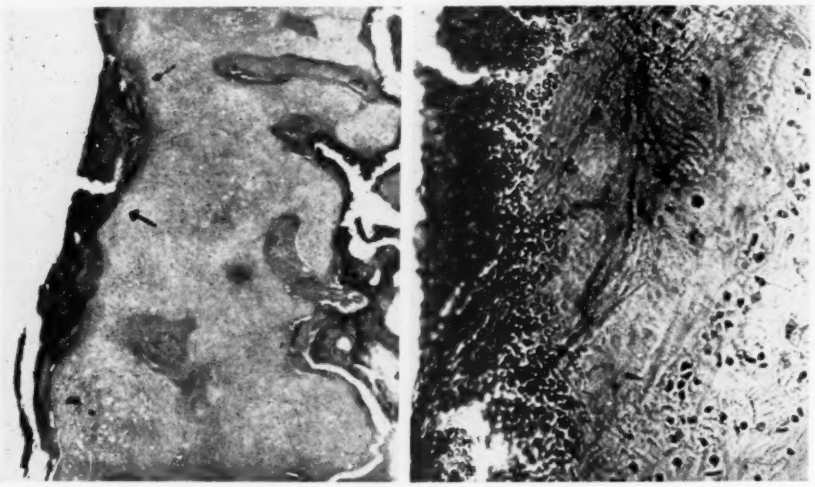
10. Carter, W. W.: The Effect of Chromium Poisoning on the Nose and Throat: Report of a Case, M. J. & Rec. **130**:125-127, 1929.

11. Bloomfield, J. J., and Blum, W.: Health Hazards in Chromium Plating, Pub. Health Rep. **43**:2330-2351, 1928.

cartilage with the perpendicular plate of the ethmoid and backward to the vomer, becomes arrested. Healing then takes place, the bone not being attacked, and the cicatrix usually becomes covered with an eczematous crust of mucus.

Roederer,[12] on the other hand, states that the perforation may well involve the bony portion of the septum and, indeed, may be located solely in the bony septum. He believed that, in view of his findings, medicolegal suits might arise, because previously all perforations of the bony septum had been considered most likely to be of syphilitic origin.

Inasmuch as all septal perforations in our series were of the cartilaginous variety, and no other author mentions perforation of the bony septum due to chrome or chromates, it seems reasonable to assume that the patient presented by Roederer



A, low-power magnification showing area of necrosis and atrophy of cartilage. (Reproduced with permission of Dr. Nath.)

B, higher magnification, showing area of atrophy of cartilage with superficial necrosis and hemorrhage. (From Zvaifler.[14])

had an unusually large perforation which appeared to have involved the bony septum.

Bloomfield and Blum substantiate Lehmann's opinion. They found, after careful study of six different chromium-plating plants, that there was no evidence of systemic disease in 23 patients examined.

Watson-Williams[13] states that the chrome solution paralyzes ciliary activity and coagulates the underlying epithelium, acting as an analgesic, with the result

12. Roederer, J.: Perforation de la cloison nasale chez un ouvrier travaillant dans le chrome, Bull. Soc. franc. dermat. et syph. **45**:662-663, 1938.

13. Watson-Williams, E.: Chrome Ulcerations of the Nose, Practitioner **140**:619-624, 1938.

that further applications of the solution do not irritate the patient. This author describes the order in which the pathological changes occur in the septum and divides them into four stages, as follows:

1. The only sign of pathology of the nasal mucosa in the earliest stage is hyperemia on the anterior portion.

2. In the second stage, the hyperemic area becomes dry and pale, the epithelium is lost, and a thin scab is formed. If the scab is detached by picking or sneezing epistaxis may occur.

3. In the third stage, the perichondrium perishes owing to lack of blood supply, exposing the cartilage. The area of exposed cartilage may be smaller than the ulceration. Once the perichondrium is destroyed, the cartilage nearly always turns brown and undergoes necrosis.

4. If the ulceration is bilateral, a perforation is produced. If only one side is ulcerated, perforation occurs only on further exposure to chromic acid.

According to Williams, healing may take place in any stage, but damage in Stages 2 and 3 is often more extensive than it at first appears. A perforation is permanent, but the edges may heal.

In his series, 60 persons were examined, and 28 were found to be affected, most of them being in Stages 1 and 2. He believed that preemployment examination of potential chromate-plant workers was definitely in order, in view of the fact that he found two persons who had perforations of the nasal septum before starting work at the plant.

Zvaifler [14] states that many persons with moderate pathology present no symptoms; symptoms, therefore, could not be used as an accurate index of the degree of pathology present. He further states that bleeding, scabbing, dryness, and other nasal irritations completed the picture as he had seen it. However, in 5 to 10% of his cases the general dryness of the nose sometimes extended into the posterior pharynx, with a few persons showing actual scabbing or crusting.

SUSCEPTIBILITY

Williams states that there appears to be a definite correlation between the seriousness of the condition and any nasal deformity, such as deviation of the septum. Zvaifler agrees with this view and hypothesizes that spurs and deflections of the septum allow more concentration of the chromic-acid fumes in one area, consequently causing the pathology in that area to be more pronounced. He believes that there is a definite susceptibility to the disease but that persons who are susceptible may have greater involvement the more prolonged their exposure. He also says that once the condition is established, it seems to remain relatively stationary.

Our cases bear out all these above statements aside from the last. It seemed that the size of the perforation continued to increase upon more exposure until practically the entire quadrilateral cartilage had been destroyed.

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14. Zvaifler, N.: Chromic Acid Poisoning Resulting from Inhalation of Mist Developed from 5 Per Cent Chromic Acid Solution: Medical Aspects of Chromic Acid Poisoning, J. Indust. Hyg. **26**:124-126, 1944.

Legge said that a certain degree of immunity might be acquired if the first few months were passed without perforation. This statement was borne out in our cases.

SYMPTOMS

The first symptoms ordinarily noted by the patients are sneezing, watery rhinorrhea, and epiphora. These might be followed by dyspnea and a sensation of fullness or choking in the throat. Dizziness, weakness, tremor, generalized malaise, and dull headache were also noted by a few patients. After 2 to 12 weeks, epistaxis usually follows attacks of sneezing.

Within the first two to three months, thick mucoid anterior and posterior nasal discharge is ordinarily described. Heavy crusts, or "slugs," occur in the nose. Removal of these by blowing or picking usually precipitates a mild bout of epistaxis. Most of the patients complain of dryness and burning of the tongue, mouth and throat.

After six months to one year of exposure, abnormal sensation of taste or lack of taste as well as relative or absolute anosmia may be noted. Many of the patients also complain of decreased auditory acuity.

TREATMENT

Bloomfield and Blum suggest bicarbonate of soda as a nasal douche with a bland nasal ointment being used twice daily as an adjunct. Zvaifler believed use of vitamin A and D ointment to be more efficacious as a treatment.

Watson also advised the use of a bland ointment, such as petrolatum. He said that preventive procedures should be carried out. In addition, he believed that persons in whom the symptoms developed should withdraw from the occupation. In many cases, however, this last suggestion seems hardly feasible from the economic aspect.

WORKING CONDITIONS

In the plant from which our patients were drawn, crude chrome ore was being transformed into bichromate of soda and potassium bichromate. Each employee was given a device similar to a gas mask for protection from the fumes. The plant was aerated as well as possible. Nasal ointment and facilities for showers were provided, and showers immediately after work as well as the use of nasal ointment and nasal douches were strongly advised.

A first-aid room with modern facilities was present in the plant, with a registered nurse on duty at all times and a physician who came in for sick call daily and was on call at all times.

STATISTICS

Inasmuch as 100 persons were examined, all the figures given are equivalent to percentages. It should be remembered that not all the workers, since they were chosen at random, had the same amount of exposure; some were office workers and others worked outside the buildings in which the chemical transpositions were taking place. However, the majority actually worked inside the plant.

The statistics were recorded for 26 separate factors, and an attempt was made to differentiate these as to degree.

A. *Nasal Septum*

1. Deviation, 79
   (*a*) 1+, 23
   (*b*) 2+, 42
   (*c*) 3+, 14
2. Color variation from normal, 88
   (*a*) Pale, 7
   (*b*) 1+ injection, 32
   (*c*) 2+ injection, 54
   (*d*) 3+ injection, 7
3. Ulceration, 92
   (*a*) 1+, 22
   (*b*) 2+, 56
   (*c*) 3+, 14
4. Perforation, 65
   (*a*) Small, 35
   (*b*) Large, 30

B. *Turbinates*

1. Moisture variation from normal, 95
   (*a*) Dry, 73
   (*b*) Excess mucus, 22
2. Engorgement, 98
   (*a*) 1+, 9
   (*b*) 2+, 49
   (*c*) 3+, 33
   (*d*) 4+, 7
3. Hypertrophy, 93
   (*a*) 1+, 26
   (*b*) 2+, 23
   (*c*) 3+, 36
   (*d*) 4+, 8
4. Response to phenylephrine (Neo-Synephrine) 1%
   (*a*) Normal, 71
   (*b*) Fair, 21
   (*c*) Poor, 8

C. *Oral Mucosa*

1. Injection
   (*a*) Normal, 81
   (*b*) 1+, 13
   (*c*) 2+, 6
2. Moisture
   (*a*) Normal, 99
   (*b*) Dry, 1
3. Ulceration
   None
4. Perforation of soft palate
   None

D. *Pharyngeal Mucosa*

1. Color
   (*a*) Normal, 39
   (*b*) 1+, 37
   (*c*) 2+, 20
   (*d*) 3+, 4
2. Moisture
   (*a*) Normal, 99
   (*b*) Dry, 1
3. Ulceration
   None

E. *Vocal Cords*

1. Color
   (*a*) Normal, 71
   (*b*) 1+, 24
   (*c*) 2+, 5
2. Ulceration
   None
3. Moisture
   Normal

F. *Ears*

1. Canals
   (*a*) Normal, 88
   (*b*) Pus, 1
   (*c*) Cerumen, 11
2. Tympanic membranes
   (*a*) Normal, 82
   (*b*) Perforated, 4
   (*c*) Retracted, 14
3. Audiogram
   (*a*) Normal, 21
   (*b*) Perceptive loss, 62
   (*c*) Conductive loss, 17

G. *Sense of Smell*

(*a*) Normal, 98
(*b*) Decreased, 1
(*c*) Gone, 1

H. *Sense of Taste*

1. Anterior two-thirds of tongue
   (*a*) Normal, 90
   (*b*) Decreased, 9
   (*c*) Gone, 1
2. Posterior one-third of tongue
   (*a*) Normal, 99
   (*b*) Slightly decreased, 1

I. *Sinus X-Rays*

(*a*) Normal, 74
(*b*) Thickened membrane, 13
(*c*) Cloudy, 8
(*d*) Polyp, 3
(*e*) Fluid, 2

J. *Transillumination of Sinuses*

(*a*) Normal, 78
(*b*) Dim, 20
(*c*) Dark, 2

CONCLUSIONS

The effects of chromates, as seen from the main part of this paper, are reported to be many; however this assumption was not borne out by the recent survey. The affected regions were those that were brought into direct contact with the chromate particles, the effect growing progressively less the farther away from the site of entry into the body. Thus, 88% of persons examined showed a color variation from normal of the septal mucosa; 65% showed septal perforation (many perforations large enough to draw a handkerchief through); an additional 27% showed ulceration, the total with ulceration, perforation, or both being 92%. Similar effects were noted on observation of the turbinates, with 95% showing moisture variation from normal, 98% engorgement, and 93% hypertrophy.

In line with this reasoning, only 61% showed color variation from normal of the pharyngeal muscoae. There was no ulceration, and only one had variation in moisture.

With regard to the vocal cords, still farther away from the site of entry, only 29% showed color variation, and none showed ulceration or moisture deviation. As to the oral mucosa (which should be affected very little except in the case of mouth breathers), only 19% showed color variation, one variation in moisture, and none ulceration or perforation of the soft palate.

There was little or no effect noted on the ears aside from the decrease in auditory acuity that might be expected in persons who work in noisy industry. The sense of smell was within the limits of normal expectancy. However, the sense of taste was abnormal in 10% in the anterior two-thirds of the tongue and slightly decreased in 1% in the posterior one-third of the tongue. The effect on the sinuses was equivocal.

CYSTS OF THE LARYNX

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UNDER the heading cystoma of the larynx, St. Clair Thompson [1] states that such cysts are due to retention from obstruction in the duct of a muciparous gland or distention of a lymphatic vessel. Their commonest situation is on the anterior surface of the epiglottis. They are also found on the ventricular bands, the aryepiglottic folds, and the external (pharyngeal) surface of the larynx. They rarely occur on the vocal cords, and when a growth in this situation collapses with escape of fluid upon being grasped or incised, it is generally a fibroma which has undergone edematous degeneration. These cysts may be broad-based or pedunculated. The surface is smooth, globular, and semitranslucent, and blood vessels are frequently seen coursing over it. The color is grayish-yellow, pink, or red. Simple incision is generally not effective. Part of the cyst wall should be torn away with forceps or a hole burnt into it with galvanocautery or diathermy. Occasionally a cyst is so large or refills so rapidly that it cannot be dealt with simply through the mouth. If such a cyst causes much laryngeal obstruction or develops back from the aryepiglottic fold, it can be operated on through lateral pharyngotomy. (To minimize the necessity for lateral pharyngotomy, a serious procedure, the cyst contents should be evacuated daily to relieve laryngeal obstruction. Then an attempt to remove the cyst through the mouth should be made.)

Similarly, the Ballengers [2] say that cysts of the larynx are primarily retention cysts which develop from an obstructed duct of a mucous gland and are usually inflammatory in origin. Branchial and dermoid cysts may occur. (Echinococcus cysts are rare.) Excision per os may be done, followed by mild cauterization of the base. With large cysts external operation may rarely be necessary.

F. L. Lederer [3] classifies four types of cysts of the larynx: (1) embryonal or congenital, (2) retention, (3) lymph or blood, and (4) traumatic (implantation).

The great majority are retention cysts formed by the closing off of a duct of a gland as a result of some inflammatory process. Most of them occur in the region of the epiglottis. Congenital cysts contain tissues which are derivatives of both meso-

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1. Thompson, S. C.: Diseases of the Nose and Throat, Ed. 3, New York, Appleton-Century-Crofts Company, Inc., 1927, pp. 543-544.

2. Ballenger, W. L.: Diseases of the Nose, Throat and Ear, Ed. 6, Philadelphia, Lea & Febiger, 1930.

3. Lederer, F. L.: Diseases of the Ear, Nose and Throat, Ed. 6, Philadelphia, F. A. Davis Company, 1952, p. 887.

derm and endoderm. Lymph cysts due to coalescence of lymph spaces are rare. There may be varying degrees of laryngeal obstruction and hoarseness. Marked dyspnea or asphyxia occasionally occurs. Dysphagia may be a symptom if the cyst is located so as to interfere with the pyriform space or entrance to the esophagus. The prognosis is grave in the very young and serious in older patients, especially in the event of any sudden increase in size of the cyst. Removal of the growth makes the prognosis favorable, owing to the rarity of recurrence.

Cysts of the larynx may be temporarily evacuated by puncture with any penetrating instrument. The hole thus made through the cyst wall remains open longer if heat (ignipuncture or diathermy) is used. Permanent removal is accomplished through the mouth by snare followed by mild cauterization of the base or, if the growth is very large, by external operation—lateral pharyngotomy. The cyst and its wall may be ablated by punch forceps.

Branchial cysts are the result of the persistence of parts of the branchial arches or of displaced embryonic rests. Imperatori and Burman [4] state that when such cysts are found within the larynx and are large, they are best removed by thyrotomy, in which they are bitten out with punch forceps. A coagulating current in conjunction with a snare or biting forceps can be used to minimize bleeding. A branchial fistula may be outlined with methylene blue and may be destroyed by electrocoagulation. Usually it should be dissected out.

Gordon B. New,[5] of the Mayo Clinic, in a comprehensive article writes of his experience with "Congenital Cysts of the Tongue, Floor of Mouth, Pharynx and Larynx." He declares that congenital cyst of the larynx may not produce symptoms until adult life but may cause death should the larynx suddenly be obstructed by an expanding mass at the base of the epiglottis or the side of the larynx. Such cysts are rare and should be removed as soon as detected. Smaller congenital cysts of the larynx or branchial cysts extending laterally in the region of the vallecula may be removed directly, and favorably, with surgical diathermy but may have to be removed by lateral pharyngotomy.

These cysts are rare and at times difficult to diagnose and remove completely. The patient may complain of repeated flare-ups due to infection of some part of the tongue, pharynx, or larynx. At the time of the flare-up the cyst may rupture, and after discharge of fluid little or nothing can be found to account for the symptoms. The cysts will, of course, probably recur. Uninfected cysts may cause no symptoms other than those due to increase in size, if indeed they ever increase in size.

In differential diagnosis a laryngocele should be kept in mind. This likewise occurs rarely. It is an air sac developing as a result of a herniation of the appendix of the ventricle of Morgagni. It is a dilatation with air of a pouch due to a congenital malformation and failure of union in portions of the thyroid cartilage. It may herniate through the thyrohyoid membrane and appear externally in the neck. It fills with air while the patient is straining as at stool. A lateral x-ray of the larynx shows two well-limited air bubbles in the region of the false cord. If the sac is filled with mucus, recognition by x-ray is not always possible.

4. Imperatori, C. J., and Burman, H. J.: Diseases of the Nose and Throat for Practitioners and Students, Philadelphia, J. B. Lippincott Company, 1935, pp. 501 and 531.

5. New, G. B.: Congenital Cysts of Tongue, Floor of Mouth, Pharynx and Larynx, Arch. Otolaryng. **45**:145-148 (Feb.) 1947.

In two such cases observed by one of us (D. J. M.), one in a 45-year-old man and the other in a 35-year-old woman, a pale, globular laryngeal cyst was a purely incidental finding. Both cysts lay between the base of the tongue and the anterior surface of the epiglottis. The man's cyst was the size of a small hazelnut; the woman's was much larger, about the size of a dark-skinned plum. On questioning, she said that while lying on her back in a certain position it was difficult for her to breathe.

A third cyst, in a boy 7 years of age, was seen by us in the Brooklyn Eye and Ear Clinic. It also was an incidental finding. The youngster was brought for a tonsillectomy and adenoidectomy. The pale, globular cyst was the size of a small hazelnut. A member of our clinic removed the cyst with a snare and cauterized the base with silver nitrate. He said the cyst sprang from the base of the tongue adjacent to the anterior surface of the epiglottis. It was filled with mucus.

A fourth cyst of the larynx was seen by one of us (La Sala) in an emergency patient brought into the Brooklyn Eye and Ear Hospital on Aug. 5, 1952, at 8:30 p. m.:

M. S., a man aged 56, a pushcart vender, had had difficulty in breathing for two weeks, yet his wife said he refused to seek medical attention until that evening. A local physician gave him an injection of penicillin and told him to go to the Brooklyn Eye and Ear Hospital. The wife said that her husband had had no previous illness. The patient was very apprehensive and had great difficulty in breathing and in swallowing. There was no stridor or cyanosis. The teeth were irregular and were covered with tartar and debris. The right tonsil was enlarged, with surrounding edematous swelling. On mirror laryngoscopy a large smooth cyst-like swelling apparently arising from the right tongue-base area was seen. This mass was so large that it occupied the hypopharynx and almost completely obstructed the glottis. The neck showed a very sensitive swelling on the right side above the clavicle. Heart sounds were normal. On examination of the lungs, breath sounds were distant and râles were heard in both lungs.

Phenobarbital sodium, 2 grains, was given intramuscularly, an ice collar applied to the neck, and an emergency call sent for laryngobronchoscopic consultation. An attending surgeon at hand consulted with us, and an emergency tracheotomy was decided upon. Forty-five minutes after the patient entered the hospital, while the operating room was being prepared for the tracheotomy the patient suddenly had extreme difficulty breathing, an ashen-gray cyanosis developed, and he stopped breathing. The surgeon digitally lifted the mass away from the glottis while one of us did an immediate tracheotomy on the patient in bed. After an opening was quickly made in the trachea and was kept open, artificial respiration was begun and continued, but the patient could not be revived.

At postmortem examination significant findings were as follows: Tongue, epiglottis, larynx, trachea, and main-stem bronchi were removed *in toto* with the lungs. In the fossa between the tongue and the epiglottis and arising from the base of the fossa, from the posterior surface of the tongue, and from the entire right anterior aspect of the epiglottis was a thin fibrotic walled cyst approximately 3 cm. in diameter. It was ruptured during removal. It was generally smoothly lined but showed a few areas that probably represented slight hemorrhage or inflammation. The larynx was edematous, especially the tissue in the ventricles, which were obliterated. The edema extended down to the beginning of the trachea. Both lungs were markedly congested and in some areas appeared focally consolidated, as if there may have been some aspiration of foreign matter.

In discussion following the presentation of this paper at a staff conference of the Brooklyn Eye and Ear Hospital, the surgeon of our division was of the opinion that the inflammation in the right side of the neck forming a tender swelling, together with the right peritonsillar edema, suggested an infected branchial cyst. He also concurred that it was unwise to cauterize more than lightly the base of laryngeal

cysts (usually the anterior surface of the epiglottis) after removal. Heavy cauterization may produce subsequent scarring and distortion of the epiglottis, thus interfering with normal function.

A laryngeal cyst so large that it causes dyspnea should be collapsed as soon as it is seen. Any instrument that is at hand plunged through the cyst wall will empty it of its contents. If there is no dyspnea it is preferable to create as large a hole as possible in the cyst wall with a biting, punch, or other forceps while the patient prevents aspiration by forcibly exhaling. This procedure removes the obstruction and prevents the immediate refilling of the cyst that follows its incision and drainage.

SUMMARY

Four cases of cysts of the larynx are described. Such cysts are rare, are usually asymptomatic, and are discovered as an incidental finding. They may have a flare-up due to infection, producing symptoms by increase in size until they (*a*) rupture spontaneously, in which case little or nothing can be found on examination, or (*b*) expand greatly, producing increasing dyspnea until, because of obstruction of the larynx, asphyxia results. As soon as it is seen a cyst producing dyspnea should be collapsed by plunging any instrument that is at hand through its wall.

433 Eastern Pkwy.

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NEW TECHNIQUE FOR CORRECTIVE SURGERY OF NASAL TIP

IRVING B. GOLDMAN, M.D.
NEW YORK

IN RHINOPLASTY the correction of the nasal tip has challenged the surgical skill and esthetic sense of surgeons. It is, in effect, axiomatic that "the tip makes the nose." It can also be said that most of the imperfections in a rhinoplasty are readily discernible in the reconstructed tip.

One may ask: "What are the surgical and esthetic errors and mistakes in failures to approximate the perfect nasal tip? The "pinched-in" surgical tip is not only esthetically inadequate but also, as a rule, functionally imperfect. The sacrifice of cartilage or vestibular skin or mucosa, with healing followed by contracture-induced synechiae between the lateral crus and septum or columella and, in some cases, between the lateral nasal wall, septum, and mesial crura, often gives a bizarre effect. The production of alar clefts, alar collapse, vestibular stenosis or artesia, dimples and dents in the alae, web-like cicatrices in the vestibule, and scar tissue in the vestibular recess are attributable to injudicious removal of components of the intranasal lining or the cartilage of the tip.

Perhaps the earliest suggestion regarding molding the tip can be found in an article by Aufricht,[1] in which he wrote that he was able to "round out" an acute-angled sharp, narrow, pointed tip by segmenting the lower lateral crus while it was still attached to the vestibular skin. By packing and supporting the nostril in this position and permitting the cartilage to heal therein he produced an angle which no longer was sharp, because the mesial crura now bent downward.

Recently, Fomon and his co-authors [2] evolved a technic to reshape the nasal tip by cross hatching the lateral crus until the spring completely disappeared. This technic was satisfactory in their hands, and they maintained that it produced results superior to those of other methods heretofore untilized in fashioning the tip.

It occurred to me that if the size and shape of the cartilage could be altered by reshaping the part customarily removed, a better physiologic and nonsurgical-appearing tip would result. It was with great anticipation of a successful result that the L-shaped incision was carried out (Fig. 1). The result was strikingly effective. A bulbous tip became amazingly thin without sacrifice of intranasal skin, mucosa, or cartilage. It transiently appeared as a collapsed nostril. On healing, however, the tip stiffened and became the thin, natural-appearing one

From the Division of Rhinoplasty of the Otolaryngological Service, Mount Sinai Hospital, and the Rhinoplasty Service, Beekman Downtown Hospital.

1. Aufricht, G.: A Few Hints and Surgical Details in Rhinoplasty, Laryngoscope **53**:317-335 (May) 1943.

2. Fomon, S.; Goldman, I. B.; Neivert, H., and Schattner, A.: Management of Deformities of the Lower Cartilaginous Vault, A. M. A. Arch. Otolaryng. **54**:467-472 (Nov.) 1951.

desired by the rhinoplastic surgeon as well as the patient (Fig. 2). Subsequently the appearance of the tip improved, in contradistinction to results obtained with former surgical technics, which as a rule tended to leave a "pinched" appearance as contracture took place because of sacrifice of skeletal tissue.

Fig. 1.—Diagrammatic frontal view of nose showing effect of L-shaped incision on right lower lateral crus after it has been freed and cut at angle. The convex lateral crus becomes depressed, causing corresponding external area of tip to lose its bulbous appearance.

Fig. 2.—Cross section of tip illustrating mechanism of correction. *A*, contour of cartilage causing typical bulbous appearance. *B*, effect of L-shaped incision of lateral crus. Note loss of abnormal convexity without sacrifice of cartilage. *C*, insertion of columellar batten forces ends of lateral crura to project upward simultaneously, further reducing convexity; extends tip forward, and keeps tip in planned position.

TECHNIQUE OF NASAL TIP RECONSTRUCTION

The membranous septum having been transfixed, the upper and middle cartilaginous vaults corrected, and the nose shortened, the next step in the customary rhinoplasty is correction of the nasal tip. This is anesthetized by circular intranasal infiltrations. A circumferential incision is made along the margin of the nostril (Fig. 3 *A*). The lower lateral crus is freed, delivered, and incised at the desired angle (Fig. 3 *B*, *C*, and *D*). The mesial crura are reattached near their ventral margins with No. 000 chromic catgut sutures on double-armed straight needles. Another

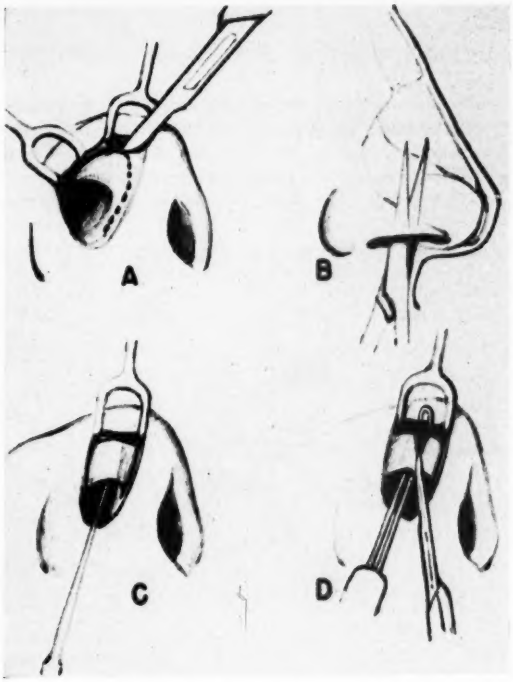

Fig. 3.—Exposure of lower lateral cartilage: *A*, marginal incision; *B*, Joseph scissors inserted through incision separating cartilage from overlying tissue; *C*, delivery of freed lower lateral cartilage with hook placed at angle; *D*, division of lower lateral cartilage at angle over curved grooved director.

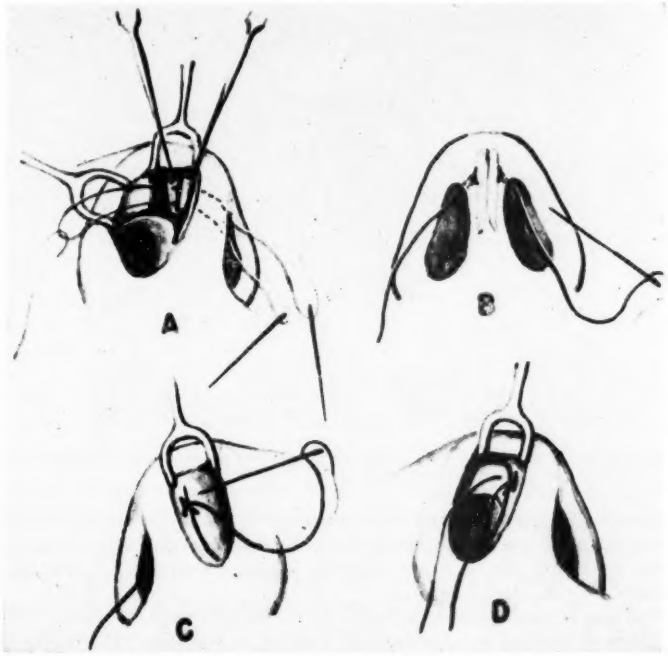

Fig. 4.—Reattachment and shaping of mesial crura: *A*, properly trimmed mesial crura brought together with suture threaded through two straight needles, another strand hooked through suture on contralateral side before tying of both; *B*, one end of suture on each side cut and rethreaded on left side; *C*, threaded needle passing through left side of septum; *D*, two strands ready to be tied, approximating mesial crura to septum.

strand of No. 000 chromic catgut is passed through the loop on the contralateral side of exit of the needles (Fig. 4 *A*). Both sutures are tied. One end of each suture on both sides of the crura is cut. The other ends are long enough so that when one is threaded in the eye of a needle it can be inserted in the septum, passing out through the corresponding side, and tied to the long strand of catgut previously left, thus serving as a septocolumellar suture (Fig. 4 *B*, *C*, and *D*).

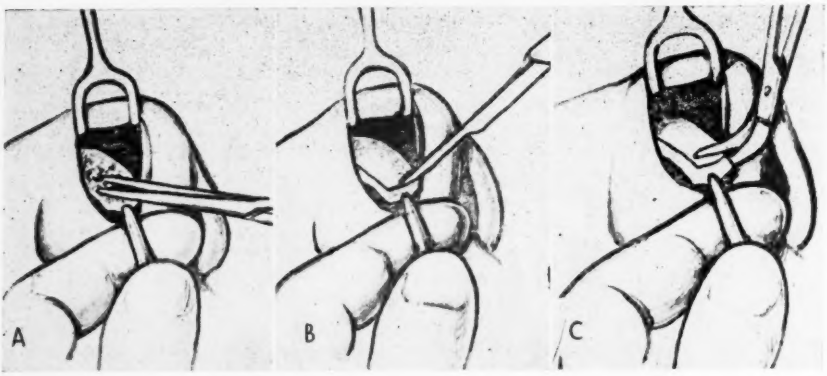

Fig. 5.—*A*, lateral crus freed of soft subperichondrial tissue. *B*, L-shaped incision in cartilage avoiding vestibular skin. *C*, completion of incision with small angulated scissors; lateral crus becomes limp and loses bulbous appearance.

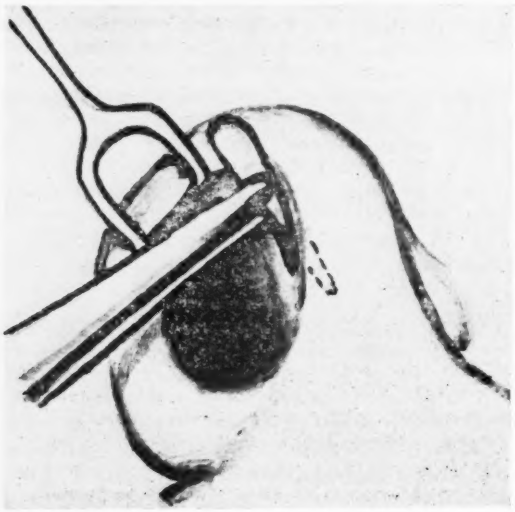

Fig. 6.—Insertion of columellar batten beneath skin and caudal to mesial crura helps drape and adds gracefulness to curved arch at apex of tip.

This suture accurately approximates the ventral margin of the mesial crura to the septal midline, draws the columella upward in the direction of the septal dorsum, and aids in the prevention of subsequent dropping of the tip. This procedure is not always necessary. The mesial crura can be reattached and the sutures cut short.

The lateral crus is now delivered, grasped with forceps, and freed of adherent soft subperichrondrial tissue so that the exposed cartilage attached to vestibular skin appears glistening

(Fig. 5 *A*). An L-shaped incision is made in the cartilage, the long arm of which is parallel to the caudal margin (Fig. 5 *B*). The incision, which passes through the cartilage but avoids the vestibular skin, is completed with an angulated flat-bottom scissors so that the cartilage spring is completely broken (Fig. 5 *C*). The lateral crus becomes limp and practically falls within the nostril; on reinsertion in the vestibular recess it resumes its form but is minus its bulbous appearance. The lateral crus of the opposite side is similarly treated. At times the lateral crus becomes so relaxed that it may not remain in its correct position in relation to the margin of the nares. Pressing the loose crus to the nostril with a forceps and holding it in this position temporarily agglutinates the two structures, and they usually remain together. If not, one or two fine black-silk sutures will accurately approximate the lateral crus to the nostril.

Occasionally there is a residual bulbous effect. The cartilage is then cut at an angle, usually cephalically with reduction, or the size of the cartilage may require sacrifice of a small redundant piece so that the crus fits accurately in the lower cartilaginous vault.

The nose is packed with petrolatum gauze. The necessity for insertion of a batten or button of cartilage becomes a matter of judgment. The cartilage implants serve a useful purpose, and I use one or the other as frequently as I can (Fig. 6).

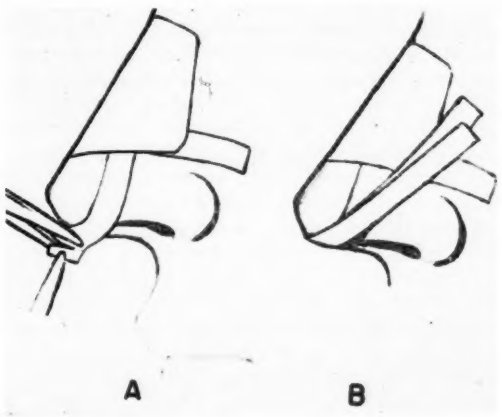

Fig. 7.—Position of remodeled lower lateral cartilages assured by careful adhesive dressing and support with petrolatum gauze. *A*, strips of adhesive placed caudal to lobule and at approximate junction of mesial crura and septum; broad rectangular piece supplied to dorsum. Immobilized tip structures made snug by gentle tightening of caudal strip of adhesive and removal of excess. *B*, separation of cut adhesive edges prevented by superimposing strip in front and another slightly above.

The last step consists in readjusting and molding the tip by manipulating the skin and the cartilages and circumspectly strapping them with adhesive strips (Fig. 7 *A*). Because the tip is soft and loose, and the skin therefore conforms to the altered shape of the cartilage, this step requires careful attention. The adhesive dressing is put on snugly (Fig. 7 *B*). The parts heal in the new position. Finally, a stent dressing is applied. The packing, dressing, and stent should be removed after four days. The dressing is reapplied for another four days.

This technic of remodeling the tip has the advantage that it does not require sacrifice of the lateral cartilage or vestibular skin. It is a physiologic correction. The telescoping effect of the L-incision produces a tip which will be narrowed and will not heal with a "pinched," surgical appearance postoperatively. Preservation of function, absence of synechiae, retention of vestibular recess, and a normal appearance are the advantages of the method described.

121 E. 60th St.

Case Reports

INTRANASAL ENCEPHALOMENINGOCELE

G. S. FITZ-HUGH, M.D.
CHARLOTTESVILLE, VA.

INTRANASAL encephalomeningoceles or those found penetrating the lamina cribrosa into the nasal cavity are rare. It is believed that they are reportable if for no other reason than to increase the alertness of the rhinologist to their possible presence. Alertness was deplorably lacking in this particular incident, as will be seen in the following condensed case report.

H. C. H., aged 5 years, in November, 1949, was first brought to a rhinologist by his parents, with a complaint of continuous clear nasal discharge and cough. After clinical and x-ray examinations, a diagnosis of allergic rhinosinusitis was made. At this first examination a small polyp was noted in the right anterior ethmoid region. The treatment advised was as follows: x-ray therapy to the sinuses; an antiallergy regimen, consisting essentially of the elimination of offending antigens, and intermittent use of antihistamines. Later, a tonsillectomy and adenoidectomy were performed for sufficient reasons. During the following three years, the patient was seen 12 to 15 times by his local physician and by two rhinologists, the second rhinologist being myself. Definite improvement was noted in the condition of the nose and sinuses, subjectively and objectively and by x-ray examinations, during this period.

In June, 1950, on the occasion of a check-up office visit, a small polyp was removed from high in the right side of the nose, with a nasal snare. A solution of epinephrine-cocaine solution was used topically as the anesthetic. After this procedure, nothing unusual was noted in the quantity of nasal discharge or general condition of the patient. No antibiotics had been or were given. During August, 1951, the patient was seen in the office and recurrence of the polyp noted. It was removed under the same conditions as before, with no complications.

In October, 1952, the patient returned with his mother, who had an additional complaint, namely, that she had noticed a slight but persistent excoriation of the skin of the right vestibule of the nose, which she attributed to continual wiping of the nose by the child. After questioning of the mother and examination of the patient, it seemed likely that there was excessive right nasal discharge and that the excoriation was due to repeated cleansing of the nose. However, no gross nasal discharge could be demonstrated at this time or at any time thereafter, even with compression of the jugular veins. The mass thought to be a polyp was again present. For the first time it occurred to me that I was dealing with more than a simple nasal polyp. The previous x-rays were reexamined, and more obtained in an effort to demonstrate a bony defect in the roof of the right side of the nose, without success. I still could not demonstrate cerebrospinal rhinorrhea.

On Nov. 21 the patient was admitted to the University of Virginia Hospital and given antibiotics, and with general anesthesia the right side of the nose was examined. A freely movable, thick-walled mass, measuring approximately 3 by 1 by 0.5 cm., was noted between the middle turbinate and septum. The consistency was soft, and the color, dark reddish-gray. The mass apparently extended downward from the roof of the nose into the nasal cavity. It was engaged in the wire of a nasal snare and severed without avulsion. Slight bleeding occurred. No definite cerebrospinal fluid could be demonstrated then or at any time after the procedure. A small strip of gelatin sponge (Gelfoam) was placed between the turbinate and septum. Recovery was uneventful.

From the Department of Otolaryngology, University of Virginia Hospital.

The report from the pathological laboratory on the tissue was: "Encephalocele. The tissue consists mostly of brain tissue covered with nasal epithelium."

On Nov. 29, Dr. Juan de D. Martinez [1] performed a right frontotemporal craniotomy. On the right side of the cribriform plate, just posterior to the crista galli, an opening in the dura and bone, 8 mm. by 4 mm. was found. The dural defect was closed with interrupted black-silk sutures. Two free implants of preserved dura were placed intradurally and extradurally to protect the line of sutures. The defect in the bone was plugged with a pledget of absorbable gelatin sponge. It was believed that a watertight closure was obtained. Subsequent events proved this belief to be correct. There was an immediate decrease in the nasal discharge and disappearance of skin irritation in the right vestibule. Six months after operation, examination disclosed no evidence of a tumor mass in the nose or of any unusual nasal discharge. There was and still is evidence at intervals of a mild allergic rhinosinusitis.

COMMENT

This case presents several unusual features, which will be mentioned briefly.

Although there was evidence of increased right nasal discharge after the second effort to remove the supposed polyp, no gross cerebrospinal rhinorrhea could be demonstrated, as can usually be done in the cases of cranionasal fistulae following trauma.

The polypoid-like mass was manipulated and incompletely excised on two occasions, without benefit of antibiotics and, fortunately, without the development of meningitis.

No broadening of the nose or evidence of other congenital deformities was demonstrated.

There was no pulsation or change in size of the mass when the child was crying. However, the position of the mass did apparently vary, at times being more posterior between the turbinate and septum, thus being less discernible. The mass was never large enough to cause troublesome nasal obstruction.

The picture was complicated by the presence of a definite allergic rhinosinusitis, but not to the degree that there was any justification for failing to make the correct diagnosis of meningoencephalocele.

Once the correct diagnosis was made, the solution was prompt: first removal of the mass intranasally and then repair of the defect intracranially.

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1. Department of Neurosurgery, University of Virginia Hospital.

COMPLETE OBSTRUCTION OF THE ESOPHAGUS BY A WEIGHT-REDUCING TABLET

JAWAD HEDAYATY, M.D.
AND
CHARLES R. SHUMAN, M.D.
PHILADELPHIA

AN INERT, water-absorbing compound, methylcellulose, has been employed for the past several years in preparations given by mouth for relief of constipation. The effect is entirely a mechanical one with the absorption of large amounts of moisture providing increased bulk to the gastrointestinal contents. More recently, similar preparations in tablet form have been advertised for the purpose of reducing weight. The anorectogenic effect of these preparations is presumably achieved by the swelling of the hydrophilic substance within the stomach. The therapeutic efficacy of the method requires considerable further study.

A recent report in *The Journal of the American Medical Association* [1] described complete esophageal obstruction in a 67-year-old man who had ingested a methylcellulose preparation for the relief of constipation. In the present report, the obstruction was produced by enlargement of a patented weight-reducing tablet (Fastabs) containing vitamins, minerals, and carboxymethylcellulose.

REPORT OF A CASE

R. M., a 20-year-old white woman, was first seen in the accidents dispensary at Temple University Hospital on the evening of July 21, 1952, complaining of difficulty in swallowing and choking sensations. About an hour before, she had swallowed two methylcellulose tablets, and a few minutes later she felt that one or both tablets had stuck in her throat. Shortly thereafter, one of the tablets was regurgitated. However, the choking sensation persisted, and she observed that she was unable to swallow.

The past medical history was irrelevant. The findings on general physical examination were essentially negative, except for moderate obesity. Indirect laryngoscopy showed nothing of importance in the larynx or upper portion of the pyriform sinuses. However, when she was requested to swallow a small amount of water, it was immediately regurgitated.

Roentgen examination of the neck and cervical esophagus showed complete obstruction of the passage of barium mixture at the cervical level. Particles of barium adhered to a rounded foreign body, the anteroposterior dimension of which appeared to be about 1 cm.

Esophagoscopy was performed in the Chevalier Jackson Bronchoscopic Department the following morning. With topical anesthesia, a 9 mm. by 30 cm. esophagoscope was advanced to the cricopharyngeal orifice, and a tightly impacted mass of grayish, rubbery material was encountered. The mucosa showed a moderate degree of edema; this was partially obscured by residual barium from the roentgen examination of the previous evening. Because of its size, the foreign body could not be removed intact but was brought out in fragments through the scope with a large fenestrated grasping forceps. After removal of the mass, the esophagoscope passed easily into the upper thoracic level. No ulceration was observed.

Comparative roentgen examination of the cervical esophagus on the following day showed nothing abnormal. The patient was discharged and experienced no further difficulty.

From the Departments of Bronchoesophagology and Medicine, Temple University Hospital.

1. Belmont, M. H.: Esophageal Obstruction Due to Methylcellulose, J. A. M. A. **148**:372 (Feb. 2) 1952.

In this patient, there was no underlying organic obstructing lesion of the esophagus, as demonstrated by esophagoscopy and barium swallow after removal of the offending mass. The large size of the tablets (11 mm. diameter and 5 mm. thickness) may predispose to the lodgment in the esophagus, where the rapid absorption of water leads to tight impaction. If this type of treatment can be demonstrated to be effective for patients with obesity, it is suggested that the tablets be manufactured in smaller sizes. It is also possible that a gelatin coating may be employed to prevent the complication reported herein.

SUMMARY

A case of esophageal obstruction due to the ingestion of a methylcellulose tablet advertised as effective in the treatment of obesity is reported. The obstructing mass was removed by way of the esophagoscope after it was demonstrated to completely occlude the esophageal lumen.

TREATMENT OF MIXED TUMOR OF TONGUE WITH RADIOACTIVE CHROMIC PHOSPHATE SOLUTION

CLAUDE S. MUMMA, M.D.
LOS ANGELES

The patient (H. J. K.), a white man 57 years old, was admitted to the hospital on July 5, 1949, for treatment of a vesicular eruption of both hands. On examination, in addition to the skin lesions, a mass of discrete cervical nodes was found beneath and anterior to the angle of the right jaw. The patient stated that the swelling was noticed four or five months previously. His attention was called to it by his associates rather than by any localized pain or discomfort. Slight discomfort had been present, but it was thought to be due to a cervical arthritis which had been present for three or four years. There was a feeling of fullness on swallowing, which the patient said he thought was due to his "uvula." A right simple mastoidectomy had been done in 1928, with no residual effects.

In the search for the etiological factor of the adenopathy, a moderately large indurative lesion was found in the tongue. It involved the posterior half of the tongue on the right side and extended downward into the base. It measured approximately 3 by 3 by 0.5 cm. The tonsillar area, the pharyngeal wall, the hypopharynx, and the larynx were normal.

A biopsy of this mass prompted a diagnosis of mixed tumor of accessory salivary-gland origin. A suprahyoid dissection of the node mass was done. Frozen sections at the time of the operation were interpreted as adenocarcinoma. Fixed specimens were later interpreted as neoplastic extension to capsules of regional lymph nodes and mixed tumor of the salivary gland with adenocarcinomatous features.

On Oct. 12 in conjunction with the radiological department, 15 radon seeds, 7.6 mc. per seed, were distributed throughout the mass. Between Nov. 21 and Dec. 22 a total of 5,023 r (skin), half-value layer 1.56 mm. cu, was given to the right lateral jaw and submentally to the right hypopharynx.

On Feb. 1, 1950, when it was found on examination that there was still tumor tissue present in the tongue, an additional course of x-rays was ordered; 3,162 r (skin), half-value layer 1.56 mm. cu, was given to the right jaw area and submentally to the base of the tongue. In addition, 1,402 r (skin), half-value layer 1.15 mm. cu, was given transorally to the right base of the tongue. Treatment was completed on March 7.

After therapy there was no material change in the local tongue condition. The lesion was still palpable. There was a moderate-sized area of ulceration over its surface. In the absence of response to both x-ray therapy and insertion of radon seeds, in consultation with Dr. Andrew Dowdy, of the x-ray department, it was decided that an interstitial injection of chromic phosphate ($CrP_{32}O_4$) should be tried.[1]

On April 13, 4.6 cc. of radioactive chromic phosphate in colloidal solution, with a tumor dose of 40,000 rep per gram, was injected into the lesion interstitially. The tongue reaction was minimal, as was the patient's discomfort. The lesion regressed, leaving a deep fissure on the right lateral surface of the tongue. The fissure extended from approximately the anterior tonsillar pillar downward to the level of the epiglottis. The tongue medial to this fissure was indurated and appeared to be involved by an extension of the original process.

From the Veterans Administration Center.

Chief, Head and Neck Surgical Service, Wadsworth General Hospital, and Clinical Professor of Surgery, University of California School of Medicine at Los Angeles.

1. The radioactive chromic phosphate solution was prepared in the Radioisotope Laboratory at the Veterans Administration Hospital by Dr. Raymond Libby and Mr. Manuel Tubis.

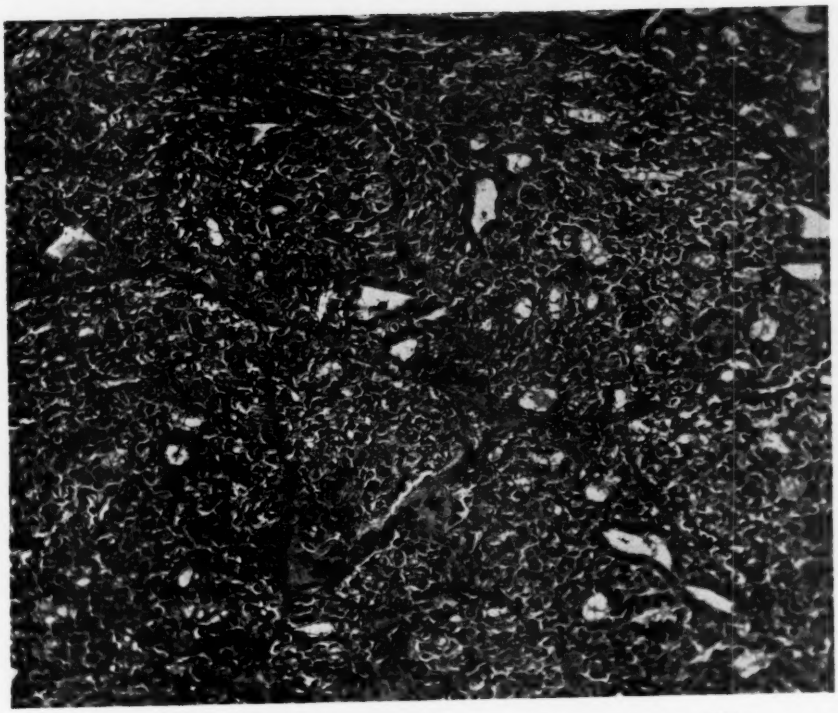


Fig. 1.—Mixed tumor of tongue, low-power photomicrograph (× 150).

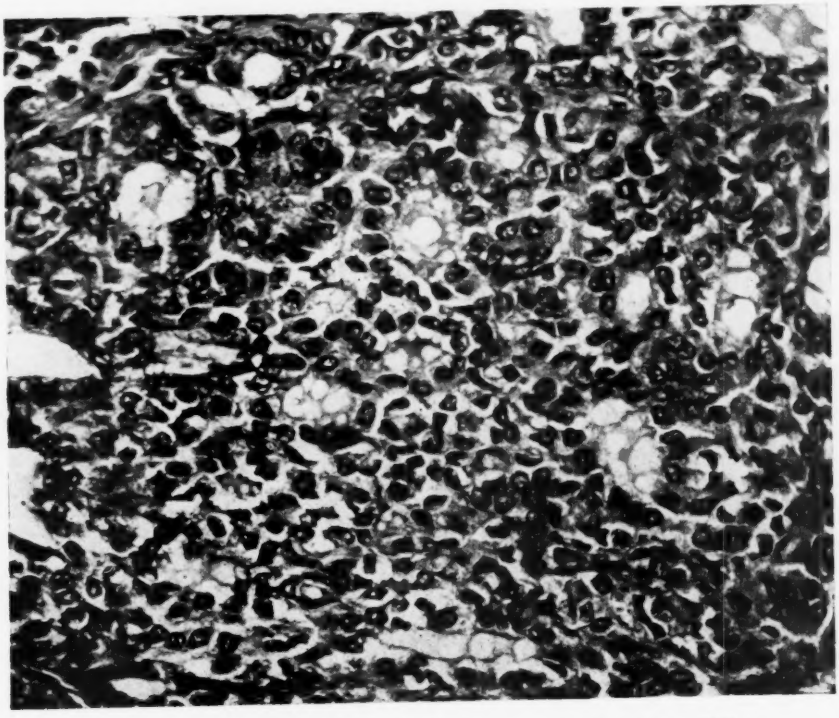


Fig. 2.—Mixed tumor of tongue, high-power photomicrograph (× 500).

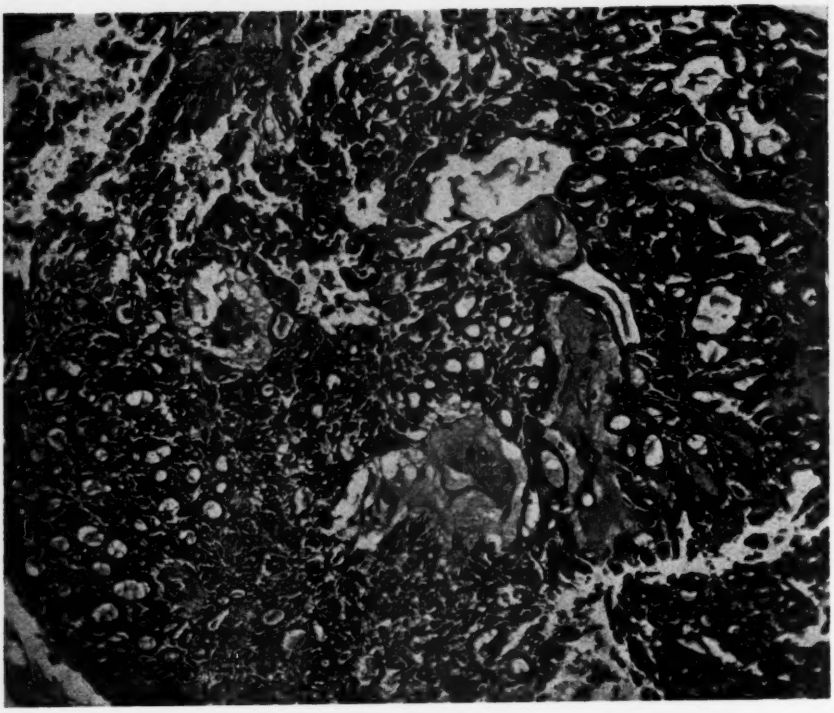


Fig. 3.—Mixed tumor of tongue, low-power photomicrograph (× 150).

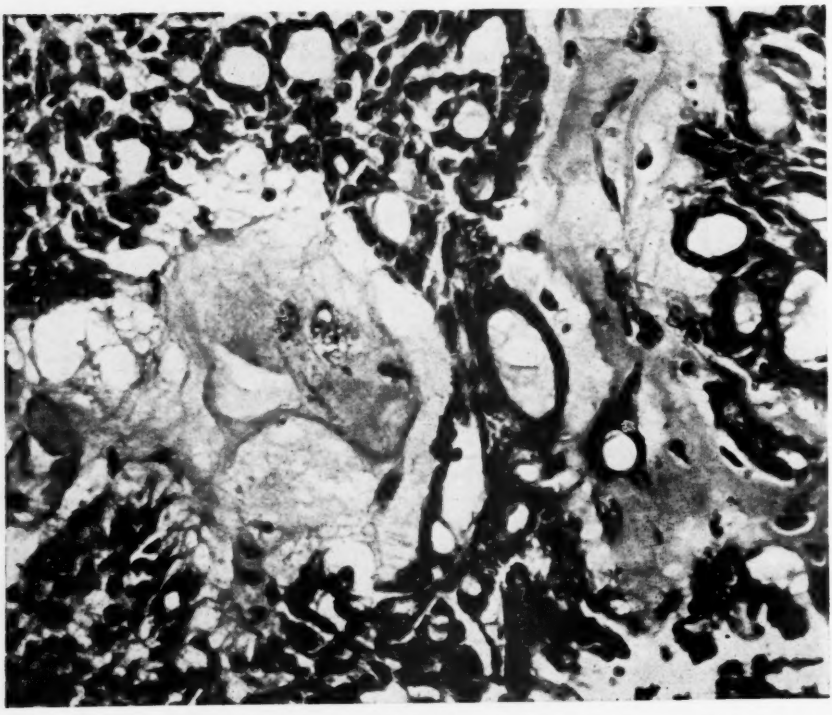


Fig. 4.—Mixed tumor of tongue, high-power photomicrograph (× 500).

On July 10 an additional 5.5 cc. of colloidal chromic phosphate, with a tumor dose of 66,144 rep per gram, was injected. After this injection the tumor was reduced to approximately one-half its original size, leaving still some induration anteriorly. The ulcer healed.

On Sept. 20 an additional 2.5 cc. of the solution, with a tumor dose of 50,000 rep per gram, was injected into three separate areas of the remaining tumor mass. After each injection there were minimal swelling of the area and only a slight amount of pain.

The patient was seen at regular intervals after the last injection. The tongue was soft. The area of previous tumor invasion was soft and pliable, without any induration. The neck cicatrix was pliable. There was no adenopathy. The patient's general condition was good.

SUMMARY

A case is reported of mixed tumor of the tongue of salivary-gland type with adenocarcinomatous features. The metastatic lesion was surgically controlled. The primary tumor did not respond to two courses of irradiation and of radon-needle insertion. After three separate injections of colloidal chromic phosphate solution ($CrP_{32}O_4$) there were regression and final disappearance of the tumor mass. There has been no evidence of recurrence in three years.

Clinical Notes, New Instruments and Techniques

MODIFICATION OF THE JACKSON ESOPHAGOSCOPE

A. ALBERT CARABELLI, M.D.
TRENTON, N. J.

Since the Jackson system of esophagoscopy has been in almost universal use because of the simplicity of its design and the standardization of sizes as well as the integration of accessory instruments, this system was studied with a view to adding certain features which would facilitate esophagoscopy. It was also planned to incorporate into one instrument the advantages found in other instruments and to add some of my own so that the esophagoscope would truly be a universal instrument, without the necessity of stocking the needed sizes of the various models or modifications thereof.

As can be seen from a study of the instrument to be described, almost none of the concepts incorporated into it are original save the shape of the tip and some of the minor refinements. The basic pattern is that of the Jackson ballooning esophagogastroscope. No attempt was made to flare the distal portion of the esophagoscope with metallic bulk, as in some instruments, because it was felt that such bulk could encroach on the tracheal lumen, with resultant dyspnea, and that the esophagus could be distended more safely with insufflation of air.

The addition of an obturator with a flexible tip stemmed from a desire to make this instrument acceptable to both the open- and the closed-tube schools. Its use has caused a considerable amount of controversy. The open-tube school feels that the introduction of esophagoscopes blindly is dangerous, especially in cases of foreign body or friable lesions. On the other hand, the closed-tube school contends that thousands of gastroscopies have been done with no ill effects with a closed tube and lately have developed esophagoscopes with obturators which are introduced on the same principle with no ill effects. These instruments are fairly easy to pass, since the cricopharyngeus opens to the stimulus of the soft rubber tip. Blind introduction in the presence of foreign bodies, friable lesions, or other contraindications, however, is foolhardy, and one must be able to pass the open tube in such cases

DESIDERATA FOR AN IDEAL UNIVERSAL ESOPHAGOSCOPE

A universal esophagoscope should have features which will permit its use for both diagnostic and operative procedures, such as biopsy, dilatation, and removal of foreign bodies. Drainage of secretions and at times irrigation of the field may be necessary for some types of work. Hereafter are listed what are considered necessary specifications for an ideal esophagoscope, and the new instrument was designed to incorporate all of them: (1) The instrument must be so designed that it will be useful for diagnostic as well as for instrumental work; (2) there must be ease of introduction with or without a flexible obturator, according to the skill or desire of the operator and the nature of the task on hand; (3) the entering tip must not cause trauma either on introduction or on withdrawal; (4) it must have provision for air insufflation which can be delicately controlled by hand pressure; (5) it must have provision for constant or intermittent suction for the drainage of secretions, normal or abnormal; (6) the air channel must be usable as an irrigating channel for solutions, so that the field can be cleansed when necessary; (7) a removable window plug must be furnished for direct visualization of the lumen while insufflation is done, so that the esophagoscope can be introduced into a visible lumen at all times; (8) the aspirating and the insufflation channels must be interchangeable, so that both left-handed and right-handed operators can use the same instrument; (9) the entire system must be fairly airtight, so that loss of air is kept at a minimum and the distention of the lumen maintained; (10) a funnel aperture must be provided to "center" vision and to facilitate the introduction of

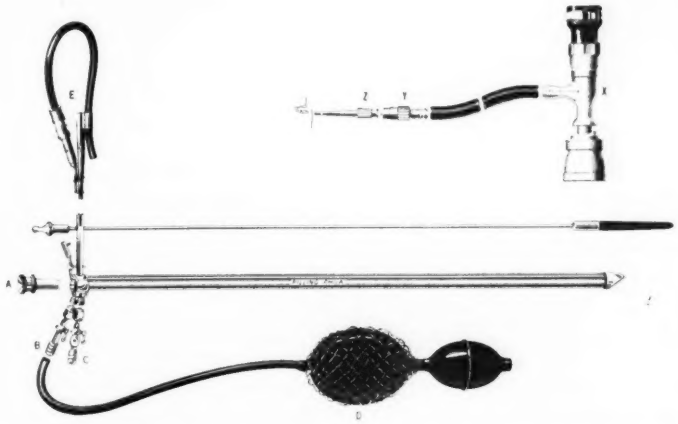
Chief of thoracic medicine, St. Francis Hospital; associate in medicine, Graduate School of Medicine, University of Pennsylvania.

long instruments; (11) provision must be made for anchoring the light carrier cord so that it does not dangle in front of the lumen, thus impeding vision or the introduction of instruments; (12) simple cleansing attachments must be provided which will obviate the necessity of special plumbing fixtures; (13) the instrument must fit into a system of esophagoscopy which is well-established and tried with respect to sizes and accessory instruments.

DESCRIPTION OF THE NEW ESOPHAGOSCOPE [1]

Structural Metal.—The instrument is made entirely of Monel, a metal which has excellent corrosion-resistant properties to most medical sterilizing solutions and body secretions. The physical as well as the chemical properties of this metal make it the one of choice over other alloys. Monel is tough, hard (almost nonindentable by tooth trauma), and thin, yet rigid and resistant to oxidation at all ordinary medical temperatures. It resists corrosion by all ordinary salts, acids, alkalis, food products, organic substances, and waters.

Funnel Aperture.—The head of the esophagoscope is milled with a funnel type of aperture which permits more easy introduction of long instruments and also serves to "center" vision.



Modification of the Jackson esophagoscope: *A*, window plug with plane glass; *B*, insufflation channel and control petcock; *C*, suction channel and control petcock; *D*, insufflation bulb and air reservoir; *E*, detail of handle, showing manner in which light cord is secured to handle; *X*, Penberthy irrigation suction apparatus, which attaches to standard faucet; *Y*, male cleansing attachment; *Z*, female tapered cleansing attachment.

Aspirating and Insufflation Channels.—These channels are rather large and are located on each side of the light-carrier channel, with their distal openings about 1 cm. from the tip of the esophagoscope. Aspiration is effected by tilting down the handle of the instrument. The proximal outlets are incorporated into the head of the instrument, so that the working length is not infringed upon. The full length of the tube can thus be used. For example, a standard esophagoscope of 53 cm. can be used only for a working length of 48 cm. because of the projecting side-arms. In the new instrument the 53-cm. size can be used for a working length of 52 cm.—an advantage of 4 cm. The attachments for the aspirating and insufflation channels are of the tapered lock type and interchangeable, so that simply interchanging the attachments makes possible use of the same instrument by either right-handed or left-handed operators. The position of the petcocks which control these channels and the thumb valve may be locked securely at any point of a 360-degree circle. Hose connections were incorporated into them so that they could be easily flushed out by attaching them to a Penberthy suction-pressure device.

1. This esophagoscope is presently being manufactured by the George P. Pilling and Son Company, 3451 Walnut St., Philadelphia, to whom I have given the specifications.

Window Plug.—This attachment is a plane-glass window with no magnification. It is easy to remove the eyepiece for cleansing simply by screwing it off the tapered plug. The body of the plug has a tapered lap fit into the head of the instrument so that there is no escape of air during ballooning procedures and the fit is more secure than the usual friction fit. For operative work the plug is removed.

Light Carrier and Cord.—These are the standard Jackson type with only two small changes. The light carrier has been equipped with a tapered sleeve which prevents escape of air from the system through the light-carrier channel. The light cord has been equipped with a simple clip secured into a slot milled in the handle of the instrument. This arrangement prevents the cord from dangling in front of the lumen.

The Introducing Tip.—This is an obliquely truncated olive which causes trauma neither on introduction nor on withdrawal. The contours of the tip blend with those of the obturator, so that it is impossible to capture any portion of mucosa between them.

The Obturator.—The proximal end of the obturator was purposely made to fit the head of the instrument snugly but not firmly, so that it could be easily removed once the instrument was introduced. The distal portion of the obturator also fits rather snugly, and the points of contact are so designed that there is a smooth continuity in the curves of both the beak of the esophagoscope and the distal portion of the obturator and no projections or pockets result. Introduction is made with the thumb on the proximal end of the obturator and the forefinger and middle finger behind the head of the instrument, so that the obturator is not pushed back into the esophagoscope. The tip of the obturator is rather long and very flexible, so that it may act in the same manner as a gastric tube, passing easily through the cricopharyngeus pinchcock. A swallow of water given at the time the esophagoscope tip is at the cricopharyngeus will almost invariably carry the instrument beyond this difficult guardian of the esophagus.

CLEANSING THE ESOPHAGOSCOPE

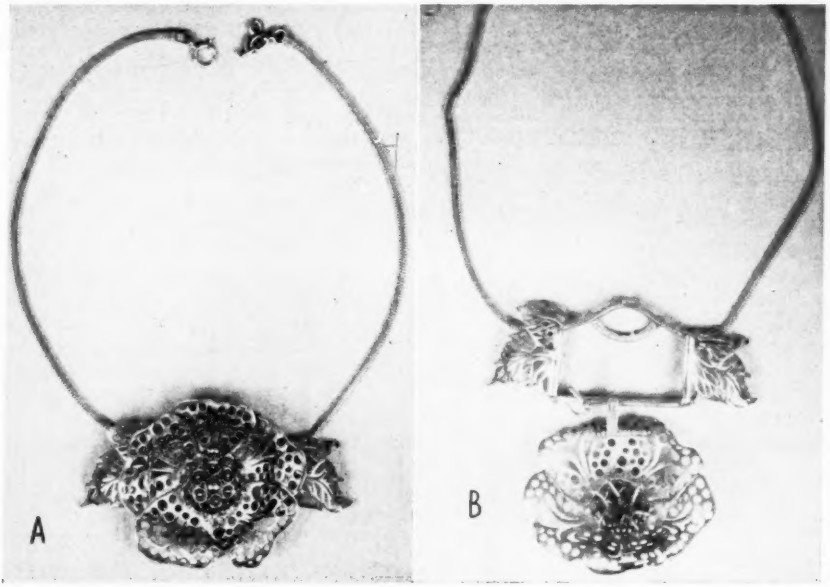
Cleansing this instrument is simple, as one look at the illustration will show. It will be noted that both the suction and the insufflation channels are equipped with petcocks which have hose connections. After use, the instrument is grossly cleansed with soap and water and the hose connections attached to a Penberthy suction-flushing device which fits on standard faucets, and the channels are cleansed by forcing water through them. If it is desired to aspirate detergents or even antiseptic solutions through these channels the Penberthy apparatus is arranged for suction and the tip of the instrument placed in a vessel with the solution desired. The light-carrier channel is cleansed by flushing with the tapered cleansing attachment. The lumen may be cleansed with the same attachment or by using an appropriate brush. After thorough cleaning of the channels, they are blown out with the bronchoscopic pressure pump to eliminate residual moisture. The instrument may then be autoclaved.

306 Hamilton Ave. (9).

DEVICE TO COVER INDWELLING TRACHEOTOMY TUBE

JOHN D. KERNAN, M.D.
NEW YORK

The present methods of arytenoidectomy and lateral suture of the corresponding cord used in the surgical treatment of double abductor paralysis of the vocal cords presents a serious dilemma. When the cord is displaced laterally sufficiently to give satisfactory respiration the voice is seriously defective. Thus the surgeon must decide between satisfactory respiration or



Brooch to conceal tracheotomy tube: *A*, closed; *B*, open, for removal and cleaning of inner tube.

a satisfactory voice. The two functions of the larynx cannot be maintained at the same time by this operation whatever the route adopted to reach the arytenoid. The same statement applies to the Lore operation, performed through a laryngofissure. There is only one procedure which will give at the same time a satisfactory voice and free respiration. That is a tracheotomy with the insertion of a valved tube. After a tracheotomy and the use of such a tube, the respiration is completely restored and the voice is normal.

The objection to the tracheotomy tube is the embarrassment caused by wearing a tube and the difficulty in keeping it clean. The device shown here goes a long way toward doing away with these objections.

A patient of mine, an invalid for 16 years, when told of the effect of an arytenoidectomy and displacing of the cord on the voice, refused the operation. She did, however, have no objection to having a tracheotomy done. In her case the result has been most satisfactory.

The tracheotomy tube has made it possible for her to enjoy active exercises, and at the same time the valved inner tube allows her the use of a normal voice.

The brooch illustrated [1] successfully conceals the tracheotomy tube. It is made in two parts, an inner one which fastens securely to the tracheotomy tube, so that it cannot be displaced, and an outer one, hinged below, which turns down for the removal and cleaning of the inner tube. By the use of two inner tubes the outer tube needs to be changed only at comparatively long intervals.

It should be stated that the patient herself suggested the idea and carried it out with the help of a manufacturing jeweler.

1. The jeweler who designed the brooch described is Mauboussin-Trabert and Hoeffer, Inc., 407 Park Ave., New York 22, N. Y.

103 E. 78th St.

INTRABRONCHIAL BOUGIES

ERNEST B. EMERSON Jr., M.D.
ROCHESTER, N. Y.

With the development of pulmonary surgery in recent years, and especially the technique of segmental resection, a few cases have been encountered in which all the preoperative information desired cannot be obtained by bronchoscopy or bronchography alone. In an effort to solve some of these problems, tracheobronchial bougies [1] have been developed (Fig. 1).

Fig. 1.—Intrabronchial bougies.

Fig. 2.—Intrabronchial bougies with the tips rounded and blunted.

The bougies are a modification of the familiar ureteral bougies, the tips of which have been blunted and rounded (Fig. 2). They are 61 cm. in length. The sizes are 4 F. through 12 F. so

From the Department of Surgery, Division of Otolaryngology, University of Rochester School of Medicine and Dentistry, and in conjunction with the Bronchoscopic Service of the Veterans Administration Hospital, Batavia, N. Y.

1. The Tracheobronchial bougies may be obtained from C. R. Bard, Inc., 490 Morris Ave., Summit, N. J.

that actual diameters of small bronchi or diameters of stenosed bronchial openings may be quantitatively recorded when they are too small or too far in the periphery to be measured by the intrabronchial caliper.[2]

The bougies may either be used through a bronchoscope or may be passed via the endotracheal catheter gun [3] and then guided to the point in question under the fluoroscope.

SUMMARY

A set of radiopaque intrabronchial bougies have been described.

They have been found satisfactory for the purpose for which they were designed, i. e., the exploration of small bronchi when additional information as to size or nature of a stenosis is desired but cannot be obtained by bronchoscopy or bronchography.

They are graduated in French sizes so that the information obtained may be quantitatively recorded, thus further aiding in the development of quantitative bronchoscopic reporting.[2]

2. Emerson, E. B., Jr.: Intrabronchial Caliper, Arch. Otolaryng. **55**:724-725 (June) 1952. Emerson, E. B., Jr.: A Bronchial Yardstick, J. Thoracic Surg. **21**:516-518 (May) 1951.

3. Emerson, E. B., Jr.: Endotracheal Catheter Gun, Arch. Surg. **82**:169-170 (Aug.) 1951.

IMPROVED POSITION FOR BRONCHOSCOPY AND ESOPHAGOSCOPY

JOSEPH M. MILLER, M.D.
AND
MILTON GINSBERG, M.D.
FORT HOWARD, MD.

In the usual technique for bronchoscopy or esophagoscopy the patient is placed in a recumbent position with the shoulders just beyond the edge of the table. The head is supported by a trained assistant. The muscles of the head and shoulders are relaxed. The head is elevated above the

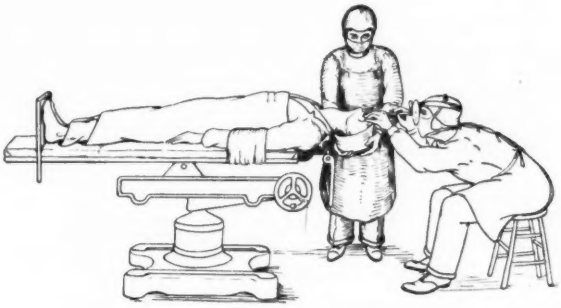


Fig. 1.—Patient in flat position, showing strained posture of surgeon.

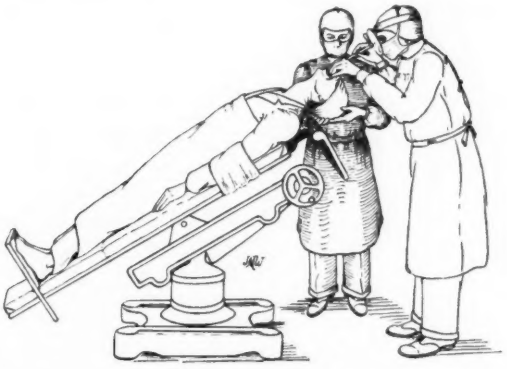


Fig. 2.—Patient in tilted position, showing comfortable posture of surgeon.

level of the top of the table and then extended at the occipitoatloid and atlantoaxial joints. The surgeon sits and is usually in a strained and awkward position (Fig. 1).

A more advantageous position can be achieved by bracing the feet of the patient on a footboard and tilting the operating table to the necessary height (Fig. 2). This position permits easier insertion of the bronchoscope or of the esophagoscope and better examination by the surgeon, who is now in a comfortable position.

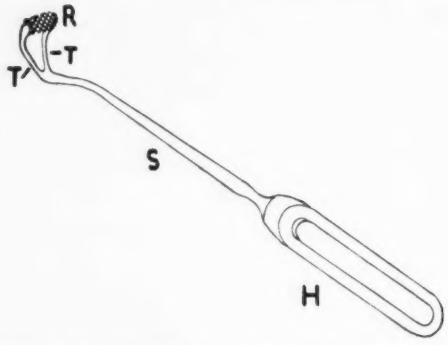
From the Surgical Service, Veterans Administration.

Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

ADENOID PRESSURE ROLLER FOR HEMOSTASIS IN ADENOIDECTOMY

MAX UNGER, M.D.
NEW YORK

Bleeding from the adenoid region immediately after removal of the adenoids is far more profuse than bleeding from the tonsil fossa after a tonsillectomy. Late postoperative hemorrhage from the adenoid site is also, in my experience, more frequent than postoperative hemorrhage from the tonsil site. I believe this situation to be due to the fact that the adenoids are removed with sharp instruments, with the result that there is an absence of the crushing and tearing of tissues that occurs during a tonsillectomy. In all my experience in tonsil and adenoid surgery, I have never seen, heard of, or read of any instrument that was designed for producing



Adenoid pressure roller: *H*, handle; *S*, shaft; *T T*, tines; *R*, knurled roller.

stasis of operative and postoperative adenoid bleeding. In order to diminish the immediate and late bleeding in adenoidectomy, I have devised the instrument described here and shown in the diagram.

The figure is almost self-explanatory. The instrument consists of a handle (*H*), a shaft (*S*), two tines (*T T*), and a knurled roller (*R*) that rotates in holes in the ends of the tines. The instrument has the familiar shape of an adenotome.

The instrument is used as follows. As soon as the adenoid has been removed, the roller is introduced into the nasopharynx up to the junction of the roof with the rear of the nasal septum. It is then rolled back along the roof and down the posterior wall of the nasopharynx, in the midline, and then on each side, with strong pressure. This procedure serves to compress and lacerate the bleeding tissues, with the result that the openings of the blood vessels are crushed together and closed. The rolling also serves to crush any small, flat collections of adenoid tissue that may have escaped the blade of the adenotome.

The effect of this pressure rolling of the adenoid site is to diminish the immediate operative hemorrhage and to reduce the possibility of later postoperative hemorrhage.

36 W. 40th St.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

FUNCTIONAL EXAMINATION OF HEARING

ALFRED LEWY, M.D.
SHERMAN L. SHAPIRO, M.D.
AND
NORMAN LESHIN, M.D.
CHICAGO

THE LITERATURE presents few new tests for hearing impairment. Considerable emphasis has been placed on early detection of hearing deficiencies, particularly in children, and on various methods for their detection. Rehabilitation and prevention of occupational deafness and its early discovery have received attention.

HEARING AIDS

The following is a list of hearing aids accepted by the Council on Physical Medicine and Rehabilitation of the American Medical Association as of Aug. 1, 1953:

Audicon Models 400, 415, 530, & 615
Mfr., National Earphone Co., Inc.
20 Shipman St.
Newark 2, N. J.

Audiotone Models 11 & 15
Mfr., Audio Company of America
5305 N. Sixth St.
Phoenix, Ariz.

Audivox Models Super 67 & 70
Mfr., Audivox, Inc.—Successor to Western Electric Hearing Aid Division
123 Worcester St.
Boston 18

Aurex Models L & M
Mfr., Aurex Corporation
1117 N. Franklin St.
Chicago 10

Beltone Mono-Pac Model "Lyric"
Beltone Mono-Pac Model M
Beltone Mono-Pac Model "Rhapsody"
Beltone Symphonette Model
Mfr., Beltone Hearing Aid Co.
2900 W. 36th St.
Chicago 32

Cleartone Models 500 & 700
Cleartone Regency Model
Mfr., American Sound Products, Inc.
1303 S. Michigan Ave.
Chicago 5

Dahlberg Model D-1
Dahlberg Junior Model D-2
Dahlberg Model D-3 (Tru-Sonic)
Dahlberg Model D-4 (Tru-Sonic)
Mfr., The Dahlberg Company
Golden Valley
Minneapolis 22

Dysonic Model 1
Mfr., Dynamic Hearing Aids, Inc.
149 Church St.
New York 7

Fortiphone Models 19LR, 20A, 21C, & 22
Mfr., Fortiphone Limited
Fortiphone House
247 Regent St.
London, W.1, England
Distr., Anton Heilman
75 Madison Ave.
New York 16

Gem Models V-35 & V-60
Mfr., The Gem Ear Phone Co., Inc.
50 W. 29th St.
New York 1

Goldentone Models 25, 69, & 97
Mfr., Johnston Hearing Aid Mfg. Co.
708 W. 40th St.
Minneapolis 8

Distr., Goldentone Corporation
708 W. 40th St.
Minneapolis 8

Maico Model J
Maico Quiet Ear Models G & H
Maico Top Secret Model L

Maico UE Atomeer
Mfr., The Maico Company, Inc.
21 N. 3rd St.
Minneapolis 1

Mears (Crystal & Magnetic) Aurophone Model 200
Mfr., Mears Radio Hearing Device Corporation
1 W. 34th St.
New York 1

Micronic Model 303

Micronic Model Mercury

Micronic Star Model
Mfr., Audivox, Inc.—Successor to Western Electric Hearing Aid Division
123 Worcester St.
Boston 18

Microtone Classic Model T-9

Microtone Models T-10, T-612, & 45
Mfr., The Microtone Company
Ford Parkway on the Mississippi
St. Paul 1

National Cub Model (C)

National Model D (Duplex)

National Standard Model (T)

National Star Model (S)

National Ultrathin Model 504

National Vanity Model 506
Mfr., National Hearing Aid Laboratories
106 S. 7th St.
Philadelphia 6

Normatone Model C
Mfr., Johnston Hearing Aid Mfg. Co.
708 W. 40th St.
Minneapolis 8
Distr., Normatone Hearing Aid Co.
22 E. 7th St.
St. Paul 1

Otarion Model E-4

Otarion Models F-1, F-2, & F-3

Otarion Models G-2 & G-3

Otarion Model H-1, Custom "5"
Mfr., Otarion, Inc.
4757 N. Ravenswood Ave.
Chicago 40

Paravox Model D (Top-Twin-Tone)

Paravox Model J (Tiny-Myte)

Paravox Model Y (YM, YC, & YC-7) (Veri-Small)
Mfr., Paravox, Inc.
2056 E. 4th St.
Cleveland 15

Radioear All-Magnetic Model 55

Radioear Permo-Magnetic (Multipower)

Radioear Model 62 Starlet

Radioear Model 72

Radioear Model 82 (Zephyr)
Mfr., E. A. Myers & Sons, Inc.
306 Beverly Rd.
Mount Lebanon
Pittsburgh 16

Distr., Radioear Corporation

Silvertone Models J-92 & P-15
Mfr., Johnston Hearing Aid Mfg. Company
708 W. 40th St.
Minneapolis 8

Solo-Pak Model 99

Mfr., Solo-Pak Electronics Corp.
Linden St.
Reading, Mass.

Sonotone Models 900, 910, 920, 925, 940, & 966

Mfr., Sonotone Corporation
Elmsford, N. Y.

Super-Fonic Hearing Aid

Mfr., American Sound Products, Inc.
1303 S. Michigan Ave.
Chicago 5

Televox Model E

Mfr., Televox Mfg. Company
1307 Sansom St.
Philadelphia 7

Telex Models 97, 99, 200, 300-B, 400, 500, 952, 953, & 1700

Mfr., Telex, Inc.
Telex Park
St. Paul 1

Tonamic Model 50

Mfr., Tonamic, Inc.
12 Russell St.
Everett 49, Mass.

Tonemaster Cameo Model

Mfr., Tonemaster, Inc.
400 S. Washington St.
Peoria 2, Ill.

Unex Midget Models 95 & 110

Unex Models 200 & 230

Mfr., Nichols & Clark
Hathorne, Mass.

Vacolite Models J & J-2

Mfr., Vacolite Company
3003 N. Henderson St.
Dallas 6, Texas

Zenith Miniature 75

Zenith Model Royal

Zenith Model Super-Royal

Zenith "Regent"

Mfr., Zenith Radio Corporation
5801 W. Dickens Ave.
Chicago 39

(All the accepted hearing devices have vacuum tubes.)

Accepted hearing aids more than five years old have been omitted from this list for brevity.

SEMIPORTABLE HEARING AIDS

Ambco Hearing Amplifier (Table Model)

Mfr., A. N. Brooks Company
1222 W. Washington Blvd.
Los Angeles 7

Aurex Semi-Portable

Mfr., Aurex Corporation
1117 N. Franklin St.
Chicago 10

Precision Table Hearing Aid

Mfr., Precision Hearing Aids
5157 W. Grand Ave.
Chicago 39

Sonotone Professional Table Set Model 50

Mfr., Sonotone Corporation
Elmsford, N. Y.

Glorig[1] briefly lists the features of performance of hearing aids on testing as follows:

1. Tolerability.
2. Intelligibility of ordinary and faint speech, difficult words.
3. How much extraneous noise is there?
4. Quality.
5. Performance under difficult conditions.

He investigated reliability of manufacture, reliability of dealer or clinic, guarantee of amount of service, and accessibility of service. Tolerance is important. It

1. Glorig, A.: Principles Involved in Selecting a Hearing Aid, Acta otolaryng. **41**:49, 1952.

may be developed with ease. Intelligibility should be tested with the same list of words and under the same conditions each time. Extraneous noise is a subjective evaluation. Plus signs may be used to indicate degree. To test performance under difficult conditions, the subject should wear the aid to movies and lectures and in crowds. Decision as to quality is subjective; the patient should consider all instruments before deciding. Auditory training is considered most important.

The author analyzed 200 cases. The test materials were the spondees and phonetically balanced (PB) words described by the Psycho-Acoustic Laboratory group. Each patient was screened through tests with 7 to 10 instruments and finally tested with 3 of these. Answers were sought to the following questions:

1. Is a highly discriminative selective procedure necessary?
2. Has it value?
3. Are there any differences in the results?

The cases were divided into conduction and perception groups. None was called mixed deafness.

When makes were analyzed, 96% of the aids finally selected came from four major makes in 1947. In 1950, 83% were chosen from four major makes, but one of the 1947 group had been replaced by another major make.

The author concludes that a highly discriminative selective procedure is unnecessary in cases of conductive loss and in 80% of cases of perceptive deafness. A training program is more valuable.

The later models show better response and more gain. They show more gain per volt and less difference in discrimination.

HEARING TESTS

Goodhill [2] describes a tinnitus-identification test. An original recording was made of some 20 different sounds and acoustical components which as closely as possible were like the sounds described by patients with tinnitus. These were artificially created by sound technicians using combined oscillators and material from a sound-effects library. A subjective statement of the patient describing his tinnitus is first obtained. A subjective analysis is then made by questioning the patient as to the location, time relations of the tinnitus, and positional relations, such as whether the tinnitus changes with different positions of the head or body. The acoustic analysis is then made. If the tinnitus is a pure tone it may be identified on the audiometer. If the tone is complex an attempt is made at audiometric analysis in terms of dominant and accessory tone. If the tinnitus is complex the patient is requested to listen to the tinnitus-identification recording to locate an acoustic component which might compare with his subjective phenomena. The frequency of positive comparisons is illustrated in the reports of a small group of cases. Goodhill presents this identification test in preliminary pilot form with the idea it may have value in clinical use.

Markle, Fowler, and Moulongalt [3] recommend the audiometer Weber test as a means of determining the need for and type of masking. For air-conduction

2. Goodhill, V.: A Tinnitus Identification Test, Ann. Otol. Rhin. & Laryng. **61**:778 (Sept.) 1952.

3. Markle, D. M.; Fowler, E. P., Jr., and Moulongalt, H.: The Audiometer Weber Test as a Means of Determining the Need for and Type of Masking, Ann. Otol. Rhin. & Laryng. **61**:888 (Sept.) 1952.

testing, masking should be used if there is a difference of 40 db. or more between the air-conduction thresholds of the two ears. They have found from their experience that 85 db. of either "white" or "sawtooth" noise is satisfactory in the majority of the cases in which masking is required for air-conduction measurement. Masking for bone-conduction measurement should be used in cases in which there is a 15 db. difference between the air-conduction thresholds or lateralization of the bone-conducted tone to the ear not being evaluated. From the writers' experience, 75 db. of either "white" or "sawtooth" noise is satisfactory in the majority of the cases in which masking is required for bone-conduction measurement. The problem of masking becomes more complicated when unequal ears are tested for bone conduction. The authors suggest utilizing the principles of the Weber test to determine which ear should be tested first and thus to which ear masking should be applied during testing for bone-conduction thresholds. They recommend using the bone-conduction oscillator instead of tuning forks, because the tone can be controlled in terms of both frequency and intensity, the sound can be sustained, and there is less possibility of the sound being heard by air. The cardiometer Weber test is performed by placing the bone-conduction oscillator on the vertex of the patient's head and obtaining a threshold while it is in that position. Ten decibels is then added to this intensity, and the patient is asked to localize the sound. This procedure is repeated for each frequency to be tested. The ear to which the tone is lateralized is then tested, and after completion of this test the oscillator is placed behind the nonlateralized ear and masking introduced to the ear not being tested. When no lateralization occurs, bone-conduction thresholds for either ear may be obtained first. Changes in lateralization produced by changes in the intensity of the test tone may indicate the presence of recruitment in the poorer ear. The routine which the writers suggest for audiometric examination is as follows:

1. Determination of air-conduction thresholds of the better ear.

2. Determination of air-conduction thresholds of the poorer ear, with 85 db. of masking if there is a difference of 40 db. or more between the air-conduction thresholds of the two ears.

3. Weber test at 10 db. above the midline threshold.

4. Weber test at maximum output of the audiometer.

5. Determination of bone-conduction thresholds of the lateralized ear or ears.

6. Determination of bone-conduction thresholds of the nonlateralized ear, with 75 db. of masking being presented to the lateralized ear.

7. Further verification of the type of hearing loss if desired, the Fowler loudness balance test being used.

Suzuki and Hirose [4] report a simple method for distinguishing between perceptive and conductive deafness. An audiogram of the ear to be tested is made before and after 8 drops of glycerin is instilled into the canal with the ear up so as to completely cover the drum membrane. In the normal ear this procedure produces a loss of less then 10 db. for frequencies of 64 to 512 cps and a loss of from 45 to 60 db. at frequencies of 2048 cps and above. In a patient with perceptive deafness in whom the sound-conduction system is intact, the hearing loss is increased by this procedure and the difference in the hearing threshold before and after

4. Suzuki, T., and Hirose, T.: A Method of Distinguishing Conductive Deafness from Perceptive Deafness, A. M. A. Arch. Otolaryng. **55**:465 (April) 1952.

instillation of the glycerin is 30 db. or more at 2048 cps and above. In conduction deafness the difference is much less than that found in either normal persons or persons with perceptive impairment. For persons whose loss before instillation is below 40 db. at the high-frequency ranges the result cannot be ascertained so precisely and such a loss does not constitute an indication for the test.

Weille [5] discusses some of the basic facts necessary for understanding speech audiometry. The two-syllable, spondee words constitute a relatively easy speech test for the patient, and if given sufficient amplification can be repeated by patients with middle-ear or nerve deafness or by those having combinations of these lesions if they have any practical hearing at 500, 1000, and 2000 cps on the pure-tone air-conduction audiogram. The one-syllable phonetically balanced (PB) words have a more difficult intelligibility because they consist of relatively intense lower-frequency vowel sounds and much weaker high-frequency consonants. The validity of any given bone-conduction curve can be checked by means of speech audiometry by using above-threshold phonetically balanced word tests. The examination is usually done at a sound-pressure level of 100 db. Response curve, in actual practice, for middle-ear deafness will lie between 82 and 98% and in cochlear damage may be very much lower, for example 40 to 50% and often less. One can arrive at an accurate opinion regarding the actual efficiency of a hearing aid in practical use by the patient by using a loud-speaker attachment having a high measured sound-pressure level at the diaphragm and testing the patient's articulation score in a free field with and without the hearing aid.

Doerfler [6] believes that psychogenic deafness exists in the civilian population in a small but sizable percentage. It will be discovered if the otologist uses the proper techniques to uncover it. There are several diagnostic symptoms and clues which can be of aid in diagnosing this condition. These are: A sudden unexplainable onset of severe bilateral perceptive hearing loss; psychogenic deafness rarely occurs with good bone conduction. The saucer-type audiogram, with a rise at both ends, with the audiometric saucer slope lying between 50 and 90 db; this type of audiogram was found in 80 per cent of the author's psychogenically deaf patients; it is suspected that such patients are utilizing an equal-loudness contour in maintaining the level of hearing which he demonstrates in such an audiogram. An unexplainable discrepancy between audiometric results and tests for the hearing of speech. A surprising response to therapy out of proportion to what one might reasonably expect. Positive findings with special tests such as the Doerfler-Stewart test, which can be given routinely in a few minutes; some centers use the galvanic skin-response test.

Guilford and Haug [7] present a test for diagnosing deafness in the very young child. The apparatus is called a pediacoumeter and utilizes seven jack-in-the-box heads, which have been properly modified to represent each of the audiometric test tones, attached to solenoids for release by the push-button switch in the hands of the child testee. A solenoid switch is also provided for the tester. The child is

5. Weille, F. L.: Speech Audiometry in Practical Use, A. M. A. Arch. Otolaryng. **55**:456 (April) 1952.

6. Doerfler, L. G.: Psychogenic Deafness and Its Detection, Ann. Otol. Rhin. & Laryng. **60**:1045 (Dec.) 1951.

7. Guilford, F. R., and Haug, C. O.: Diagnosis of Deafness in the Very Young Child, A. M. A. Arch. Otolaryng. **55**:101 (Feb.) 1952.

told to press the button when he hears the sound. This releases the jack-in-the-box, which pops up into view. If the button is pressed when there is no sound, then only a light appears. For very young children markedly deafened or mentally retarded, a conditioning test is employed, associating the jack-in-the-box pop-up with a sound as the stimulus. This test has considerable interest appeal, and the results as compared with retests were fairly accurate, showing an average difference range over all the frequencies of 2.1 to 4.2 db. The writers present this test as an improvement over other tests in that it is economical, simple to perform and understand, has dramatic and interest appeal, and is a reliable clinical tool for audiometry with children.

Tschiassny [8] studied the phenomenon of shadow-hearing in both the monaurally deaf person and the normal person having an experimental arrangement approximating the factors responsible for shadow-hearing in the monaurally deaf. A total tonal loss of about 50 to 70 db. significant for the shadow curve appeared about as often in the audiograms recorded for the monaurally deaf as in those for the experimental normal persons. This tonal loss depends on two factors, the transmission of air-conducted sound waves into the bone and the traveling of bone-conducted sound waves across the skull to the opposite side. The latter factor, which depends mainly on the transition of sound waves from air into bone, contributes only 5 to 10 db. to this effect. The shadow curve appears to be influenced by impedance factors, with the threshold of the shadow curve being raised by impedance in the deaf ear and lowered with impedance in the good ear.

Harris, Haines, and Meyers [9] made a study to determine whether the growth of loudness for pure tones and the growth of loudness for speech followed similar courses. They used the technique of alternate binaural loudness matching to explore this question. They found that irrespective of the type of deafness, recruitment for speech followed a course parallel to that for pure tones. An indication is given that increasing the loudness of speech does not cause a proportionate increase in speech intelligibility for some patients with perceptive deafness.

Gidoll [10] presents a preliminary report of a procedure by which threshold auditory acuity may be quantitatively measured without patient cooperation. This end was accomplished by using a standard audiometer for the source of calibrated and controlled sound and an eight-channel type of electroencephalograph as the index of arousal response.

The subcommittee of the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology [11] present pertinent facts and methods to be utilized in the diagnosis and rehabilitation of the preschool child with a hearing loss. An outline is given for a proper history. There are two tests of practical value for testing the preschool child with moderate hearing

8. Tschiassny, K.: Mechanism of Shadow Hearing, A. M. A. Arch. Otolaryng. **55**:22 (Jan.) 1952.

9. Harris, S. D.; Haines, H. L., and Meyers, C. K.: Loudness Perception for Pure Tones and for Speech, A. M. A. Arch. Otolaryng. **55**:107 (Feb.) 1952.

10. Gidoll, S. H.: Quantitative Determination of Hearing of Audiometric Frequencies in the Electroencephalogram, A. M. A. Arch. Otolaryng. **55**:597 (May) 1952.

11. Boies, L. R.; Canfield, N.; Carhart, R., and Keaster, J.: Hearing Loss in Preschool Children: A Guide for Diagnosis and Treatment, Tr. Am. Acad. Ophth. **56**:835 (Sept.-Oct.) 1952.

loss and normal speech. One is the test described by Keaster using 25 common monosyllables with controlled speech amplification and a talk-back system and employing two rooms. The child is given commands to do certain things, these words being used and the intensity level being increased in 2-db. steps until a response is obtained. This test requires elaborate equipment, and an effort is being made to provide a suitable record for speech testing in a single room. The other type of test is more elaborate and employs the peep show as introduced by Dix and Hallpike [12] or the pediacoumeter described by Guilford and Haug.[7] These tests employ pure-tone audiometry for children from 3 to 5 years of age, utilizing a conditioned-reflex technique. For children who do not have intelligible speech a special type of history must be taken. Tests should be done with toy noise makers as described by the Ewings [13] and Utley.[14] Special tests that can be utilized in hearing centers include psychogalvanic skin-resistance audiometry and sound-field testing. The proper advice to parents is discussed, including suggestions for training the deaf child, guides to learning, and the introduction of speech. A sketch shows how a standard television or radio set can be revised so as to permit a hard-of-hearing child to listen with his own headphones, the level being monitored to meet his volume requirement. A bibliography is also given for parents who wish to do further reading.

Wishart [15] criticizes present methods employed in otological clinics for the testing of hearing defects in children because they are too time consuming and employ apparatus and techniques which are not practical for the individual clinical otologist. These procedures are not necessary except for research. He describes the physical set-up and technique utilized at the Hospital for Sick Children in Toronto, Canada. The hearing clinic and ear, nose, and throat outpatient suite are housed together. For testing, a modification of the peep-show technique is used, with colored movies and still pictures. After the child's interest and confidence have been gained with the peep show, he is introduced to headphone hearing by using the Melody Master and listening to gramophone records. For testing older children a high-fidelity gramophone audiometer is used, with the fading-numbers record of Western Electric recording K.S. 6091. The patient replies by speaking the numbers he thinks he hears. Nonsense sentences and meaningless speech sounds have been discarded, and Wishart and his colleagues believe that speech-reception thresholds and discriminating scores have no value whatever in the testing of children's hearing. Loud-speaker free-field testing is condemned because it uses live voices, which cannot be satisfactorily controlled, and because the acoustic properties of the sound-proof room in which the loud-speaker is located are amazingly difficult to keep constant for subsequent testing. All tests are very short. As soon as the child's interest or cooperation lags the test is discontinued. Attention is called to the usual lengthy periods devoted to audiologic technique and work-up in the usual audiologic

12. Dix, M. R., and Hallpike, C. S.: Peep-Show: New Technique for Pure-Tone Audiometry in Young Children, Brit. M. J. **2**:719 (Nov. 8) 1947.

13. Ewing, I. R., and Ewing, A. W. G.: Ascertainment of Deafness in Infancy and Early Childhood, J. Laryng. & Otol. **59**:309 (Sept.) 1944.

14. Utley, J.: Suggestive Procedures for Determining Auditory Acuity in Very Young Acoustically Handicapped Children, Eye, Ear, Nose & Throat Month. **28**:590 (Dec.) 1949.

15. Wishart, D. E. S.: Problem of Hearing Defects in Children, Ann. Otol. Rhin. & Laryng. **61**:762 (Sept.) 1952.

clinics as compared with the brief time devoted to history taking, examination, and treatment of the child. To correct these difficulties the otologist should be brought directly into the picture, his interest should be aroused in the problem, he should be taught to use methods of testing suitable for children and to discard research techniques, and he should be set to work at diagnosis and treatment. He should apply the methods he uses for the adult to the child, persevere in treatment, and remember the vast recovery powers of the child. Wishart[16] discusses this subject further in the 1952 Herbert Stanley Birkett lecture, "A Critique of Present Day Methods of Hearing-Testing."

Hirsh[17] discusses some of the principles of amplification and how they apply to hearing aids. The hearing aid does not actually aid hearing, it only aids or enhances sound. To determine who can wear a hearing aid successfully one must determine how the auditory system responds to amplification. The determination of the audiogram threshold or even the threshold of intelligibility for speech will not answer this question. One must determine the behavior of the auditory system to increasing intensity of sounds above threshold, namely, supralimal measurements. Recruitment measurements and speech audiometry tests give such information The latter determine two independent properties of the auditory system in recognizing the sounds of speech, one the need for amplification and the other the ability to discriminate among the sounds of speech when the intensity is sufficiently high. For the hearing loss for speech the difference between the normal threshold of intelligibility and the patient's threshold of intelligibility is determined by the intensity of sound necessary for the listener to repeat correctly 50% of a list of words presented to him. The material used is usually sentences or two-syllable words. For discrimination tests fairly difficult words are used at a relatively high intensity, so high that a further increase in intensity will not improve discrimination. The Psycho-Acoustic Laboratory's phonetically balanced (PB) lists have been very useful for these measurements. The highest percentage of the words on a given list that a patient can repeat correctly at this high intensity is measured. Normal-hearing people can repeat 80 to 90% of the words at an intensity level of 100 or 110 db. For persons with a nonattenuative hearing loss the maximum score is much less. This type will not benefit from amplification alone, since amplification will not improve the ability to discriminate. This fact clearly limits the usefulness of a hearing aid. The only means known at present to increase discrimination among sounds at a given intensity is a form of educational therapy as auditory training.

Reger[18] discusses the minimal requirements of equipment for satisfactory audiologic work. First is the speech audiometer, which enables the examiner to determine the patient's hearing loss for speech in decibels in relation to the normal speech-reception threshold intensity level or any other designated zero reference level. A speech-function curve can be obtained by plotting the number of PB words perceived at different intensity levels, which indicates the patient's ability to perceive speech at above-threshold levels. This instrument when equipped for

16. Wishart, D. E. S.: A Critique of Present Day Methods of Hearing-Testing, Laryngoscope **62**:1045 (Oct.) 1952.

17. Hirsh, I. J.: Hearing Aids: How They Work and for Whom, Ann. Otol. Rhin. & Laryng. **60**:1032 (Dec.) 1951.

18. Reger, S. N.: Minimal Requirements of Equipment for Andiological Work, Ann. Otol. Rhin. & Laryng. **60**:1028 (Dec.) 1951.

free-field testing is indispensable in the selection of hearing aids and in checking hearing-aid performance. Pure-tone audiometers can be modified for speech tests by being equipped with accessories which permit the reproduction of speech in the audiometer earphone. An additional power amplifier and loudspeaker are needed for free-field testing. The second instrument on the list is the pure-tone audiometer. This instrument reveals data about the acuity at frequency levels above the speech-frequency range. Pure tones are most convenient for detecting diplacusis. Bone-conduction measurements can be made at higher-frequency levels than are possible with forks or with the speech audiometer. The pure-tone audiometer can be used for measuring recruitment. Relationships between test results obtained with the speech and the pure-tone instruments are often needed to differentiate between so-called control and peripheral auditory dysfunction. The pure-tone audiogram also serves as an indication of disability. Tuning forks are included in the list of equipment for audiologic work. The tuning fork remains the simplest and most foolproof vibrator for the measurement of bone-conduction acuity. Some noise makers or percussion toys should be available for use in observing the reactions of young children. The training and scientific integrity of the person using the equipment is of much greater significance than the physical significance of the equipment itself.

Dodson and King[19] propose a method for determination of the normal threshold of hearing and its relation to the standardization of audiometers. The normal threshold of hearing by earphone listening was determined under controlled conditions to assist in the establishment of a reference standard for the calibration of audiometers. The authors describe the objective basis of calibration at present in use at the National Physical Laboratory. Their results are in agreement with recent measurements made at the Central Medical Establishment of the Royal Air Force and the classic results of Sivian and White over the frequency range of 250 to 8000 cps.

The results differ rather widely from those obtained in two recent United States surveys, one of which now forms the basis of an American standard. It is suggested that there should be further international discussion with a view to a possible agreement.

Auditory fatigue and adaptation are described as different kinds of reduced sensitivity by de Maré.[20] Fatigue is temporary and reversible; it precedes permanent tissue damage. Adaptation has a normal physiochemical basis. Fatigue is a progressive process; adaptation is an adjustment to a stimulus, with rapid development and rapid regression. Adaptation can be demonstrated only with stimuli of short duration. A sharp distinction between adaptation and fatigue is not always possible. The author describes experiments in this field done by himself and others. The anatomical substrate of fatigue must lie between the areas of electrocochlear activity and the action potentials of the cochlear nerve. The clinical significance of auditory fatigue and auditory adaptation is discussed. Fatigue is an important factor in the clinical determination. Individual variation in normal hearing organs

19. Dodson, R. I., and King, J. H.: Determination of the Normal Threshold of Hearing and Its Relation to the Standardization of Audiometers, J. Laryng. & Otol. **101**:366 (Aug.) 1952.

20. de Maré, G.: Auditory Fatigue and Adaptation, Acta. oto-laryng. **40**:104, 1952.

demand fatigue tests for the selection of workers in noisy surroundings. The differences in fatigue and adaptation phenomena in different types of hearing disturbance are of diagnostic help.

Auditory reception in noisy surroundings is the subject of a study by Tonndorf.[21] Maintenance of communication in intense noise is essential in flying. The noise originates from the aircraft and from the communication system (static). The threshold masking is determined by only a fraction of the total-noise level. It is the sound energy present in a narrow band surrounding the frequency that is intended to be heard which defines the degree of masking. The sound energy found in such a narrow band is far less than that of the total-noise level. It was possible to obtain information on suprathreshold perception from speech and from comfortable listening tests. The latter were found to define the signal level which comprises the best possible speech perception with the least discomfort at each sound level. Protecting the ears with plugs actually improves the ability to perceive signals in the presence of noise.

The intensity of radio signals at operational level is not high enough to increase the total-sound level significantly over that produced by the aircraft noise alone. The necessity of having to pay more attention when listening under noisy conditions than in quiet imposes a mental strain.

Peyser[22] advises preemployment examinations in all industries in which the noise level exceeds 90 to 100 db. He recommends the following test of workers' sensitivity to persistent loud sounds:

> Determine threshold at 1024 cps. by air conduction; expose immediately to 100 db. for three minutes; wait 15 seconds and redetermine thresholds. After that determine thresholds by bone conduction. A difference of 5 db. indicates good acoustic resistance. Ears with 5 to 10 db. difference in air conduction and decreased bone conduction are vulnerable to industrial noise. Ears with more than 10-db. difference in air conduction plus 5 db. or more difference in bone conduction and ears with regular and durable irritations on exposure to audiometer noise are hypersensitive. Control tests should be run occasionally.

A trailer in use as a mobile hearing unit is described by Osborn.[23] It proved successful in speech-reception and intelligibility testing and in hearing-aid selection for persons in separsely settled areas.

Preliminary results of a survey among persons servicing jet engines are reported by Guild.[24] The records were compared with those of 368 men working in relatively quiet surroundings and with those of 139 experienced pilots. The average showed some loss over that expected when noise is not a factor; most of those who retained good hearing had an appreciable shift toward lower limits of the normal range. Among mechanics who showed significant impairment the severity was greater and the age of onset earlier than among men who have similar losses without exposure to noise. The author suggests that jet engines are more likely to cause auditory changes than are reciprocating engines. The need for adequate protection is emphasized.

21. Tonndorf, J.: Auditory Perception in Noise, J. Aviation Med. **22**:491 (Dec.) 1951.

22. Peyser, A.: Ear Examinations in Order to Obviate Chronic Acoustic Trauma, Soc.-med. tidskr. **28**:46 (March) 1951.

23. Osborn, C. D.: Michigan's Mobile Hearing Units, J. Speech & Hearing Disorders **16**:140 (June) 1951.

24. Guild, E.: Acoustic Trauma in Aircraft Maintenance Workers, J. Aviation Med. **22**:477 (Dec.) 1951.

Cojazzi and Lisco [25] discuss the effect of what they term biorhythm in audiology. One of the authors in a recent study had found that variations between hyperglycemia and hypoglycemia resulted in corresponding variations of 4 to 15 db. in threshold of hearing. Dell'Acqua, in 1933, found that there were notable changes in the glycemic, chloride, and protein content of the blood during a 24-hour period, while Mygind defined the labyrinth as an indicator of the general changes in the body. These changes are due to atmospheric pressure, humidity, and other factors and vary in different persons. The authors conducted a series of investigations on a number of persons, testing them at the same period of the day; in some instances the subjects also were tested at stated periods during the night. The tests were repeated after a lapse of a few days. Curves were plotted for the threshold of hearing at four-hour intervals and showed a fairly uniform variation acccording to the time of the day or night, amounting to as much as 15 db. The subjects examined during the day showed a fall at 10 and 15 (hours) and a rise at 8 and 20 (hours). The ones examined during the 24 hours showed a fall during nocturnal hours. The practical conclusion drawn by the authors is that if a record of progress for any reason is desired the audiometric examination should be made at approximately the same hour of the day.

Veckmans,[26] writing on the same subject, states that the principle of examination with the sweep method was discussed by Bunch and later by Holmgren. In 1942, van Dishoeck described a detailed method involving a circular audiogram. Veckmans, considering this to be too difficult for the average otologist, who is used to following the usual clinical audiogram, has evolved a method by which a sweep audiogram can be represented by means of curved lines which are closer to the common graphic record. This method takes into account the fact that different frequencies are not heard at the same absolute threshold level of intensity. The frequencies 1000 to 2000 cps being taken as the reference frequency band heard at 0 range (Western Electric Sweep Audiometer), tests are made at 10, 20, 30, and 40 db. across the frequency range in such a way that the observer can see at once what the hearing is expressed in terms of these intensities. The examiner simply turns the knob corresponding to the various frequencies while keeping the intensity level and notes at which frequency the sound comes on and at which one it stops, marking these points on a chart in which the intensities are represented as usual, by horizontal lines. The claim is made that this method, while fully as accurate as the one with discrete frequencies, is more rapid. Furthermore, it is excellent for catching malingerers, who cannot give the same or similar curves on repeated examinations because they do not know or cannot remember which frequencies have the threshold at certain intensities.

A revival of interest in audiometric examination with the sweep audiometer is indicated by two representative articles in the French literature. The first, by van Dishoek and van Gool,[27] discusses the disadvantages of the fixed-frequency audiometer in that narrow dips between the octave or half-octave intervals may be missed. The authors state that a method which sweeps through the entire tonal

25. Cojazzi, L., and Lisco, R.: Biorhythm in Audiology, Minerva otorhinolaryng. **2**:31, 1952.

26. Veckmans, J. L.: Registration of the Results of the Audiogram According to the Method of Van Dishoeck, Acta oto-rhino-laryng. belg. **5**:485, 1951.

27. van Dishoeck, H. A. E., and van Gool, J.: Sweep Audiometry in Clinical Practice, Rev. laryng. **72**:501 (July-Aug.) 1951.

range at intervals of 5 or 6 db. is much more scientific and also has a number of clinical advantages. Using a Western Electric Sweep Audiometer (no longer available in this country), they devised an audiogram attached to a board, with the frequency knob protruding through a hole; the board is fixed to the audiometer, while to the knob, in turn, is attached an arm with a writing stylet. When the patient is examined the intensity knob at the other end of the instrument is set at the desired level and the frequency knob with the writing arm turned through the entire available tonal range, with the patient signifying if there are any gaps. The zeroisophon, as the authors call the normal curves, are much more curved than normal audiograms taken according to the usual method, but the margin of error is unimportant except on bone-conduction examination. The authors have had an audiometer made which automatically compensates for the errors in the zeroisophon and feel that it will show the exact contour of hearing losses in various forms of deafness. Among other observations they state that there are "dips" which can be demonstrated by air conduction and not by bone conduction and vice versa. They believe that examination by sweep audiometry is superior to the usual method.

Portmann[28] gives a resumé of modern audiometric methods as used in his clinic at Bordeaux, France. These methods comprise the familiar basic concepts. The tests for recruitment originated by Fowler and by Luscher are discussed, as well as the psychogalvanic and electroencephalographic techniques and the peep-show technique for children. Pictures are included which show a complete modern double chamber (separate control room for the examiner) for pure-tone and vocal audiometry used by the author.

Two long articles, one a review on pure-tone audiometry by Pirodda[29] and the other a review on vocal audiometry by Bocca,[30] are contributed from the clinic of the University of Milan, Italy. They appear to be comprehensive, up-to-date, and well documented but offer no original data and do not lend themselves to abstracting.

Falconnet[31] writes on the value of examining hearing by means of the watch tick. This test, which is all but obsolete in this country, is the subject of a detailed study. Nine watches were analyzed by oscillographs as to frequency and other acoustic characteristics. Falconnet states that the tick of the watches lasted from one-hundredth to four-hundredths of a second and was followed by a silent pause lasting from seven-hundredths to seventeen-hundredths of a second, thus showing that, contrary to the usual impression, the silent period is longer than the noisy one. The ticks possess no low frequencies, the most important ones being located between 4200 and 14200 cps; it is rare to find the dominant wave lengths to be under 2850 cps. In measuring the hearing, it is necessary to establish normal values for the watch in use. When these are established in terms of the distance at which the subject hears the watch tick, the law of the square of the distance operates as in other hearing tests. The intensity loss is about 6 db. when the distance is doubled.

28. Portmann, G.: Modern Audiometry, Rev. laryng. **73**:1 (Jan.-Feb.) 1952.

29. Pirodda, E.: Pure Tone Audiometry, Oto-rino-laring. ital. **19**:411, 1951.

30. Bocca, E.: Vocal Audiometry, Oto-rino-laring. ital. **19**:461, 1951.

31. Falconnet, P.: The Real Value of Examination with the Watch, Ann. oto-laryng. **68**:481, 1951.

Thus if a watch is normally heard at 1 meter, a patient who hears it at 0.5 meter has a loss of 6 db. for frequencies above 3000 cps; if he hears it at 0.25 meter his loss is 12 db., and so on.

An article on audiometry by means of the psychogalvanic reflex is contributed by Faure, Portmann, Dutertre, and Brameries.[32] After discussing the nature of the psychogalvanic reflex, the authors credit Bordley and Hardt with being the first to apply this reflex to audiometry. As a result of research conducted over a number of years at Bordeaux, France, in this field, the authors believe that they have developed a superior apparatus for the purpose. In essence it involves a faradic generator capable of producing small stimuli, this means being used to condition the patient to respond (over a galvanometer) to stimuli of less than 40 db. In the authors' plan the faradic electrodes are attached to one leg and the galvanic ones to the other; the patient is in a soundproof room, stretched out and immobile, and the examiner operates the audiometer and watches the galvanometer in the adjoining room. The authors state that the results are most accurate in adults, less so in children, and least accurate in infants of less than 2 years. They claim considerable value in cases of functional hearing defects and malingering.

Livan [33] reviews the basic concepts underlying the decibel, phone, and sone. The phone, which is a loudness comparison unit favored as the standard of audiometric measurement in some parts of Europe, he finds to be subject to the limitations accompanying any subjective measurement of sensation and also "speculative mathematically." He believes that both this and the sone (which is an attempt to establish a unit of loudness on a psychologic basis) are needless complications in clinical practice and that the decibel and American type of audiogram represent the best standard of measurement and recording available.

A description of the quantitative hearing test with the Urbantschitch accordian [34] demonstrates that valuable information on the hearing can be obtained with simple equipment. Beebe contends that well-established diagnostic procedures should not be discarded.

A further contribution on osteomyelitis deafness is made by Seiberth.[35] He states that 13 cases have been reported in the last 60 years. Total loss of hearing and of vestibular response was found bilaterally six weeks after osteomyelitis of the arm. No vertigo or tinnitus was present. The author assumes a toxic neuritis as the underlying pathology. There were no signs of purulent labyrinthitis, and the cerebrospinal fluid was normal.

Reduction of the upper auditory threshold is discussed by Rossberg.[36] He states that the upper level may fall as the result of age, oxygen deficiency, or otosclerosis without stapes ankylosis and attributes the fall in all these conditions to the "hardening nodule," i. e. hardening of the bone.

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32. Faure, J.; Portmann, M.; Dutertre, F., and Brameries, R.: Audiometry by Means of the Psychogalvanic Reflex, Rev. laryng. **73**:66 (Jan.-Feb.) 1952.

33. Livan, M.: Decibel, Phone and Sounds: Study of a Scale of Sensation, Arch. ital. otol. **62**:317 (July-Aug.) 1951.

34. Beebe, H. H.: Testing the Hearing of Young Children, Nerv. Child **9**:8, 1951.

35. Seiberth, W.: Osteomyelitis Deafness, Ztschr. Laryng. Rhin. Otol. **30**:282 (June) 1951.

36. Rossberg, G.: Lowering of Upper Limits of Hearing, Arch. Ohren- Nasen- u. Kehlkopfh. **160**:230, 1951.

The localization of sound was investigated by Graybiel and Niven.[37] They found that in rotary acceleration with the head inclined toward one shoulder, in four experimental healthy males, facing the center of rotation displaced the sound downward; facing away from the center of rotation displaced the sound upward.

Kietz [38] found that the auricle, which modifies the sound pattern in the meatus according to the direction of the source, is of paramount importance in localization of sound in the sagittal planes.

Investigations of the Weber test and its dependence on pitch are offered by Kley.[39] He agrees with Mach's conception that impaired air conduction means less escape of energy through the outer canal. The tone was presented by means of an oscillator placed exactly in the middle of the skull. The output from the ear canal was received in a microphone and, after amplification, was recorded by an electrocardiograph. The output was always diminished from the ear with the more impaired conduction (and to which the Weber test was lateralized). There was an exception in the case of ears radically operated upon. Partly packing the cavity reduced the output. Conditions after mastoidectomy are too different for direct comparison.

After comparative investigations into the conductivity of the mastoid and that of the frontal bone, Link and Zwislocki [40] claimed that determinations from the frontal bone afford better diagnostic possibilities than those from the mastoid. They avoid the middle ear and are preferable, even though the bone telephone cannot be used to full advantage.

[ABSTRACTER'S NOTE.—In my experience the fork is heard longer when applied over the mastoid than when applied over the frontal bone. A. L.]

A method of determining bone conduction by old-fashioned hearing test is suggested by Loch.[41] Damage to the internal ear is determined by a bone-conduction test with a tuning fork and alternate bilateral deafening with Bárány noise apparatus. The normal ear is deafened until the affected ear no longer hears the fork through the bone. The affected ear is deafened until the fork tone disappears in the normal ear. The excess in bone conduction on one side is determined on the basis of the difference.

Owing mainly to the absence of a well-defined and universally accepted base line, the audiometric method lacks the accuracy of scientific measurements.[42] Measurements made by the United States National Health Survey (1935-1936) are not accepted, because of inaccurate controls, which render them unrepeatable. In England there is no recognized established standard of the minimum audible sound pressure. The apparatus used, its setting up, and its operation are described in

37. Graybiel, A., and Niven, J. I.: The Effect of a Change in Direction of Resultant Force on Sound Localization: The Audiogravic Illusion, J. Exper. Psychol. **42**:227 (Oct.) 1951.

38. Kietz, H.: Differentiation of Spatial Direction in Hearing, Ztschr. Laryng. Rhin. Otol. **31**:91 (Feb.) 1952.

39. Kley, W.: Investigations of the Weber Test and its Dependence on Pitch: A Contribution to an Objective Interpretation, Ztschr. Laryng. Rhin. Otol. **31**:101 (March) 1952.

40. Link, R., and Zwislocki, J.: Audiometric Bone Conduction Studies: Comparison of Conduction on Mastoid and on Forehead, Arch. Ohren- Nasen- u. Kehlkopfh. **160**:347, 1951.

41. Loch, A.: Determination of Bone Conduction by Old Style Hearing Test, Arch. Ohren-Nasen- u. Kehlkopfh. **160**:4, 358, 1951.

42. Wheeler, L. J., and Dickson, E. D. D.: The Determination of the Threshold of Hearing, J. Laryng. & Otol. **56**:379 (Aug.) 1952.

detail. Seven frequencies usually calibrated on American audiometers—256 cps to 8192 cps and including 3072 cps—were used. The results were in close agreement with the figures obtained by the National Physical Laboratory.

A determination of the normal threshold of hearing by earphone for 90 normal persons, aged 18 to 25 years, over the frequency range of 80 to 15000 cps, was made by Dadson and King.[43] The object was to obtain data under controlled conditions to assist in establishing a standard calibration for audiometers which might be accepted internationally.

The results are in agreement with data of Wheeler and Dickson [42] of the Central Medical Establishment Acoustic Laboratory of the Royal Air Force for 512 subjects of the same age group.

The results diverge rather widely from those of surveys made under the auspices of the United States Public Health Service, which are now incorporated in an American standard specification. The time may be ripe for further international discussion in the light of additional data now available, with a view to agreement on an international standard.

Schiffmann [44] uses an audiometer with two output channels, with which he claims he not only can apply the Stenger principle for the unmasking of falsely claimed unilateral total deafness, as is done with tuning forks of the same pitch and intensity, but also can determine the degree of deafness, when not total, at which the hearer fails to mask the better one, thus establishing the actual degree of deafness in the alleged deaf ear. Another advantage is that the patient is asked only about the good ear during the test.

Link and Zwislocki [40] made comparative tests of bone conduction via the mastoid and the forehead, arriving at the following conclusions: Testing of bone conduction by way of the mastoid is inconvenient and its diagnostic value unreliable in cases of inner-ear disease, insofar as it is influenced by pathological changes in the middle ear. Comparative tests of bone conduction via the forehead are more reliable, but the threshold is comparatively raised 10 db. Eleven patients with middle-ear disease with one exception showed normal forehead bone conduction, while the mastoid test showed loss. Exceptionally, there was improvement of bone conduction for the lower frequencies. Closing the canal increased mastoid bone conduction and to a greater degree forehead bone conduction. It, therefore, was osteotympanal conduction. For "pure" bone conduction the canal in both instances should be open.

Curry and Kurtzrock [45] have devised a time-saving method of testing the hearing. The subject wears two phones of equal power, one on each ear; the examiner begins with a weak tone and shifts from ear to ear, gradually increasing the intensity; he asks the subject to indicate in which ear he hears the first tone. The point at which the subject is able to locate correctly the sound in the better ear is noted and the power increased until the tone is located correctly by both ears. This procedure is followed for all the frequencies from 256 to 8192 cps. Thus a two-ear

43. Dadson, R. S., and King, J. H.: A Determination of the Normal Threshold of Hearing and Its Relation to the Standardization of Audiometers, J. Laryng. & Otol. **56**:366 (Aug.) 1952.

44. Schiffmann, H.: Contribution to the Stenger Test, HNO **3**:30 (March) 1952.

45. Curry, E. T., and Kurtzrock, G. H.: A Preliminary Investigation of the Ear-Choice Technique in Threshold Audiometry, J. Speech & Hearing Disorders **16**:340, (Dec.) 1951.

audiogram is built up. It gives substantially the same result as the standard procedure and is a good time saver. This factor is important when one is working with children with a short attention span.

Onchi [46] summarizes acoustic studies of the external auditory canal by Meyer, von Bekésy, Wiener, and himself and concludes that the resonance frequency of the external auditory canal lies between 2000 and 3000 cps and that the acoustic gain due to resonance is 20 db. This gain may be one of the causes of the apparent discrepancy between results obtained by Wiener with a receiver detached from the ear and those of American authors with a receiver on the ear.

A study of the electrophonics of the cochlea evoked by an electrode which was placed directly on various parts of the inner wall of the middle ear was made by Marujama.[47] This study was made in 20 cases on which a radical mastoid operation had been performed. The electrophonics were louder when an electrode was placed on the oval window, less loud with it on the round window, and least loud with it on the promontorium. The loudness was greater by the anode than the cathode. The author concludes that the electrophonics may be brought about by electric stimulation of the hair cells.

Normal persons have diminished bone conduction when tested audiometrically in a room which is not soundproof, owing to the masking effect of the noise in the room.[48] In a soundproof room, no masking effect is present. A better effect is present in a soundproof room if one ear is closed for the test. Lateralization may also be present. It may be caused by a phase shift, a real increase in bone conduction which may be too small to be determined audiometrically. A combined air and bone conductor with tightly fitted headphone is recommended for both bone and air conduction. It may be used in rooms that are not soundproof.

Patients referred to the hospital for deafness following streptomycin or dihydrostreptomycin therapy in most instances had with them audiograms indicative of tests performed under poor noise conditions.[49] The importance of soundproof rooms even in testing deaf patients is stressed, to insure that (1) patients with normal hearing for one or more frequencies will not be given an incorrect diagnosis as hard of hearing and (2) simple routine calibration of apparatus will be possible. A quiet place should be selected and treated for sound isolation (rather than for sound absorption). The construction of small, portable, demountable testing booths is described. It is estimated that the attenuation figures for such booths can reach 25 to 30 db.

Ability to hear supersonic sounds was tested in several patients with different types of deafness by Zangemeister.[50] In patients with high-frequency deafness there was lack of ability to hear. In patients with deafness covering the total

46. Onchi, Y.: The Mechanism of Hearing (Auditory Function of the External Auditory Canal), Otolaryngology, Japan **23**:3, 1951.

47. Marujama, M.: A Study of the Electrophonics of the Cochlea Evoked by an Electrode Which Was Placed Directly on the Various Parts of the Inner Wall of the Middle Ear, J. Oto-rhino-laryng. Soc. **54**:346, 1951.

48. Kietz, Y.: The Combined Air and Bone Conductor, Acta oto-laryng. **39**:179 (June) 1951.

49. Fowler, E. P., Jr., and Huizing, H. C.: Sound Isolation for Hearing Tests, Acta oto-laryng. **39**:367 (Oct.) 1951.

50. Zangemeister, H. E.: Ability of Hearing Ultra Sound and Possibilities of Its Utilization for Diagnosis, Acta oto-laryng. **39**:263 (June) 1951.

frequency range and in others with a loss at C^5 supersonic sounds could be heard (20 to 100 sc.). Ability to hear such sounds is not a specific test of the cochlear nerve.

Subjective changes in pitch perception can be measured by bilateral and monaural pitch balance techniques. In addition, Schubert [51] determines the percentage of differential pitch limen by comparing the test tone of one ear with a warbling frequency variation in the other ear. The maximum of subjective pitch differences with diplacusis corresponds to the maximum of the hearing loss and thus depends on frequency and intensity.

Recruitment and subjective speech differences seem to explain why speech interpretation decreases on higher levels. Various therapeutic measures may be helpful.

Ultrasonic vibrations were transmitted in several test persons at several locations on the head and received via a crystal receiver by an amplifier and oscillograph on the forehead. [52] Frequencies of 20 to 100 kcps were used, also 58 to 80 and 175 kcps (magnetic striction oscillator), approximately 1 watt capacity. The waves spread in all directions, not only at right angles with the plane of radiation. For frequencies of 175 kcps the spread was investigated by means of the acoustic impressions which are caused by ultrasonic waves. It could be proved that the acoustic impressions originate in the cochlea and not in the acoustic nerve and that the frequency of 175 kcps spreads in all directions in the skull. The impression of loudness varies with the frequency and the site of the generator. It can jump from one ear to the other with small changes in the position of the transmitter.

Functional measurement concerning the intra-aural muscles is possible by the determination of impedance variations in the conductive system. Metz [53] measured these with an impedance bridge. This technic is made possible by the fact that monaural stimulation puts the internal muscular system of both ears into action. The detector oscillations were recorded by a string oscillograph. Generally the variation in impedance remained constant during the time the stimulating tone was presented. In some cases relaxations of short duration were observed. After a still longer duration of the stimulating tone the muscles relaxed gradually without tiring, as no recovering period was found when the presenting tone was discontinued. The author suggests that relaxation is due to adaptation. After interruption of the stimulating tone the impedance returns gradually to its initial value, following a curve different from the muscle reflex.

Lund-Iverson [54] was unable to demonstrate recruitment by difference-limen determinations according to this method.

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51. Schubert, K.: Pathological Variations of Pitch Perception, Arch. Ohren- Nasen- u. Kehlkopfh. **157**:474, 1951.

52. Pfander, F.: Experimental and Clinical Studies of the Spread of Ultrasonic Waves in the Ear Region and Skull, Arch. Ohren- Nasen- u. Kehlkopfh. **160**:32, 1951.

53. Metz, O.: Studies on the Contraction of the Tympanic Muscles as Indicated by Changes in the Impedance of the Ear, Acta oto-laryng. **39**:397 (Oct.) 1951.

54. Lund-Iverson, L.: An Investigation of the Difference Limen Determined by the Method of Luscher-Zwislocki in Normal Hearing and in Various Forms of Deafness, Acta oto-laryng. **42**:219 (June) 1952.

A certain duration of tone is required for pitch recognition. The number of cycles required increases as the pitch rises. Meyer [55] investigated this duration in various forms of hearing impairment. Readings were taken at 30 to 40 db. above threshold for pure tones. In pure conduction deafness no alteration was found, but in perception deafness due to cochlear degeneration much longer durations were found, especially above 1000 cps. Since speech sounds are short, this dysfunction may be partially responsible for loss in speech discrimination and the apparent inconsistency between hearing for pure tones and for speech discrimination in perception deafness.

Schmidt [56] registered decrement of tuning forks set on an electrocardiograph and compared the tones with corresponding audiometric tones, thereby correlating the amplitude of the forks each second with decibel intensity of the corresponding audiometric tones. The calculations agreed well with the routine audiogram. The percentage of hearing loss is, therefore, deductible from tuning-fork findings if their amplitude decrement is known, as postulated by Nadoleczny.

Carhart [57] claims that the first use of the speech audiometer is to supply information which assists in the initial analysis of a patient's difficulty, such as a disturbance in discrimination for speech which cannot be explained in terms of the pure-tone audiogram or the case history. This entity becomes quickly apparent through use of speech audiometry. Classification of other clinical types is facilitated by measurement of hearing for speech.

A second use is in assessing results of surgery or medical treatment. A speech audiometer furnishes an essential guide to educational and rehabilitational management and provides a basis for judging whether the patient needs and can profit from a hearing aid and for selection of an aid.

The author suggests as a practical clinical rule that the average of losses at 500, 1000, and 2000 cps. be compared with the loss of speech reception. Losses of 129 patients compared with those of 370 patients tested with Harvard spondees were approximately the same. These results are merely a description of group trends. Many patients do not obtain close correspondence between thresholds for speech and pure-tone averages. When a discrepancy is found it may be due to a disorder of either the pure-tone or the speech audiometer, and this discrepancy must be determined. If the results correspond they give added confidence in the findings. A discrepancy not otherwise explained may suggest psychogenic hearing loss, and illustrative cases are presented. The combined results help in planning an appropriate educational or rehabilitation program. In a footnote the author states that adults with a loss at 4000 cps. may have better speech discrimination due to experience than children with the same loss. Unfamiliarity with the language is another factor.

In older people with phonemic regression, circulatory inadequacy may be a factor. Evidence of this may be found in the retina, suggesting that similar changes in the central nervous system cause loss of discriminatory ability.

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55. Meyer, E.: The Perception of Tonal Impulses of Short Duration, Arch. Ohren- Nasen- u. Kehlkopfh. **159**:354, 1951.

56. Schmidt, W.: Investigations of the Possibility of Comparing Quantitative Hearing Tests with Tuning Forks and Audiometric Tests, Ztschr. Laryng. Rhin. Otol. **30**:384 (Sept.) 1951.

57. Carhart, R.: Speech Audiometry in Clinical Evaluation, Acta. oto-laryng. **41**:18, 1952.

Efficiency of hearing aids depends not only on amplification but on the patient's phonemic discrimination. The latter appears more important than the audiometric contour. When discrimination varies from one hearing aid to another, detailed testing and study are required before adequate guidance is possible. The important thing is that speech audiometry allows the clinician to proceed with greater confidence in advising on hearing-aid use.

The author also compares hearing aid and fenestration, and fenestration plus hearing aid, describing an objective method. He says a successful fenestration operation more often than not will equal or surpass an electric aid in improving hearing performance.

Meyer [58] states that the recruitment phenomenon occurs only in association with endolabyrinthine lesions and is usually best elicited at $c.^3$ $c.^4$ or $c.^5$ Occasionally it appears best at a lower tone. Generally it becomes evident at 90 to 100 db. intensity and increases with the intensity.

Certain forms of deaf-mutism show the phenomenon at lesser intensities. Sometimes the reaction is not evident until the sound becomes painful. Frequently diplacusis or pure tones are just "noise." The author quotes many theories as to the causation of this phenomenon and concludes that it may occur (*1*) in association with endolymphatic hydrops without a lesion of the hair cells or (*2*) with widespread destruction of the membrana tectoria and the hair cells.

The author believes that the hair cells are stimulated by the membrana tectoria. He does not mention Shambaugh, Sr., but quotes Werner, who states that fish have no basilar membrane and that therefore, the stimulation is not from below. When autophonia is associated with recruitment in the lower frequencies, the author thinks it may be due to functional disturbances of the middle-ear muscles.

Fowler and Huizing [59] present a study of ambient noise as a disturbing factor in hearing tests, particularly in determining the effect of streptomycin. It is important to consider this factor in order to be sure that use of quick-needed streptomycin is not discontinued and to avoid lawsuits for loss of hearing allegedly due to streptomycin.

Absolute isolation from extraneous sound is very expensive. The National Research Council specifies as a minimum for air-conduction audiograms for the Army, Navy, and Veterans Adminstration a room where the ambient noise does not change the audiogram of a nomal observer with a receiver in place or where the ambient noise is less than 40 db. as measured on a standard sound-level meter.

The latter is very liberal and would be too noisy for accurate bone-conduction tests for normal persons. It is reasonable enough, without disproportionate expense in any hospital or clinic. If a reasonably quiet place is selected a practical installation can be had in New York City for $50,000.

A series of demountable portable booths was made by the Ihsa Company for audiometry in the public schools of Baltimore. The booths are provided with small rubber legs to minimize building vibrations sufficiently for routine testing. The inner shell of the booth wall should be of removable aluminum plates for reflection of sound; the walls should contain at least one air cushion, and solid

58. Meyer, E.: Regarding the Recruitment Phenomenon, HNO **3**:11 (June) 1952.

59. Fowler, E. P., Jr., and Huizing, H. C.: Sound Isolation for Hearing Tests, Acta otolaryng. **39**:367 (Oct.) 1952.

contact between inner and outer walls should be avoided as far as possible. The edges of the separate panels are lined with mobile gaskets so that they can be put together without leaking cracks. An attenuation of 40 db. may be obtained by use of these gaskets.

Attenuation is more difficult for low tones than for high tones. City noises of trucks, buses, and so on and selection of location should be considered with this fact in mind. The inside of the booth should be treated acoustically to prevent standing waves and for further absorption and over-all attenuation.

It is concluded that the attenuation waves may approach a value of 25 to 30 db.

A detailed discussion of the psychological aspects of auditory perception, primarily concerned with the cortical functions of acoustic discrimination, memory, attention, and synthesis, under the title "What is Hearing?"[60] is a recent contribution to the psychology of hearing.

Ettore Bocca[61] presents another differential test for cochlear deafness. This test is based upon the effect of interrupted masking on the audibility of pure tones. The number of interruptions per second at which the masking effect equals that of the same sound of the same intensity when presented continuously is checked and reported on the audiogram.

In experiments performed on a large number of subjects the rate has been found lower in cases of cochlear deafness, while it is the same as normal (7 to 11 per second) in cases of conduction or nerve-trunk deafness, except that in Ménière's disease it is often normal. The reason for this discrepancy is obscure. The test is believed to be indicative of the integrity of the cochlear receptors. Its physiological basis needs further investigation, but it may be recommended as a differential clinical test.

TRAUMA

Senturia[62] studied the effect of airplane noise on the pure-tone auditory thresholds of 100 subjects after each successive phase of pilot training, namely, primary, basic, and advanced. Fifty-four of the original group successfully completed advanced pilot training. Forty of these subjects were given audiometric retests after a period of freedom from noise of 24 hours or more. The rested ears, which showed hearing losses of various degrees sustained during primary or basic pilot training when tested after a limited period of rest, were partially or completely recovered after advanced training. Another 14 of this group were tested after one to eight hours of rest and showed mean hearing losses which were widespread, involving the frequencies 1024 to 5792 cps. inclusive. This study revealed that a large percentage of men in pilot training will show temporary hearing losses after the usual period of exposure to aircraft noise. These losses tend to involve the frequencies 1024 to 5792 cps. The more vulnerable 2896 to 5792 cps region has a greater delay in recovery. On the whole, the hearing losses incurred during training were completely recovered after 24 hours of freedom from exposure to aircraft noise.

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60. Froeschels, E.: What is Hearing? Nerv. Child **9**:2, 1952.

61. Bocca, E.: Interrupted Masking as a Differential Test of Auditory Function, Acta oto-laryng. **39**:452 (Dec.) 1951.

62. Senturia, B. H.: The Influence of Airplane Noise on Auditory Thresholds, Ann. Otol. Rhin. & Laryng. **61**:331 (June) 1952.

Sataloff [63] reports three cases of acoustic trauma in children who had permanent hearing defects produced by inadvertent exposures to cap pistols or firecrackers. Such defects are of the inner-ear type and similar to those encountered in military personnel whose hearing acuity has been damaged by exposure to gunfire. They are probably not progressive. The writer suggests more careful screening techniques to detect such hearing defects not accompanied by clinical symptoms.

Kantzer [64] contributes a long article from the Rothschild Foundation in Paris, France, on sound trauma, stating that interest in this field has grown with the development of industry until not only physicians but lay organizations are becoming aware of the harmful effects of noise on hearing. As an example the author cites the fact that the question of protection against noise and vibrations was taken up for the first time at the National Congress of Security in September of 1951. The article consists of a thorough survey of the literature on the subject plus 94 cases of the author's own. All sources of deafness due to noise, including aviation and war, are considered, although the author acknowledges that the latter may cause mixed forms due to both noise and air concussion. Statistics are quoted as to percentage of workers involved and the length of time necessary to produce impairment revealed by tests as well as hearing loss noticed by the patient; these factors naturally vary with the occupation.

A point mentioned by the author is the extent to which preexisting aural disease affects the progress of noise deafness. All authorities agree that preexisting inner-ear impairment facilitates the rise of noise deafness; some have maintained that the presence of a suppurative otitis media or ankylosis of the ossicles acts as a protective device—an opinion which the author believes is yet to be proved. In listing the symptoms arising from noise, the author also discusses general fatigue; he states that, while the majority of workers make an adjustment within a given time after they enter a noisy occupation, a small number continue to show both cortical and neurovegetative symptoms indefinitely.

The author does not believe that there is a single, unique curve which corresponds to noise deafness but, rather, three or four audiometric forms which can occur. In most cases there is a sharp drop in one of the frequencies between 3000 and 6000 cps. The distinction between sound trauma and presbycusis lies in the presence of recruitment in the former and its absence in the latter; for testing this factor he uses the method of Luscher and Zwislocki. In vocal audiometry he finds the more advanced cases to be marked by a loss of discrimination between certain sounds. Bone-conduction studies gave no characteristic findings. The experiments of Peyser, Wilson, and others with respect to tests of susceptibility are quoted, as well as many controlled experiments, using various stimuli, with regard to most harmful frequencies, recuperation, and so on. He discusses the various means of combating noise deafness, such as intervals of rest, ear protectors, preemployment and periodic auditory studies, and employment of deaf-mutes, but considers that decreasing noise by methods correct for each establishment is probably the most important prophylactic measure.

63. Sataloff, J.: Acoustic Trauma in Children, Ann. Otol. Rhin. & Laryng. **61**:107 (March) 1952.

64. Kantzer, L.: Deafness Due to Sound Trauma, Minerva otorinolaring. **2**:13 (Jan.-Feb.) 1952.

Paris and Vidal [65] made a study of occupational deafness among a group of 27 operators of turbines and gas extractors. They observed the environment and the machines involved and attempted to ascertain the dominant frequency and intensity of the noise in each of the two industries. They proceeded by matching the surrounding noise against audiometric tones of different frequencies and intensities, holding the receiver against one ear while listening to the noise with the open ear. The noise of the extractors was judged to approximate a tone of 128 cps at an intensity of 90 db.; the noise of the electric turbines, that of 512 cps at 90 db. Among 27 workers there were 9 with a complaint of deafness and modifications of the auditory field, 9 with audiometric changes without a complaint of deafness, and 9 normal subjects. Air conduction, relative bone conduction, and absolute bone conduction tests were taken. The typical curve resulting from chronic exposure to noise was judged to be that of perception deafness. The authors stress the need for means of protection against the harmful effects of noise in industry.

HEREDITY AND DISEASE

Jack and Tina Bangs [66] discuss the diagnostic, educational, and prosthetic problems in hearing-aid selection for the young child. They use the speech audiometer for determining the communicative hearing loss of children and their possession of language or lack of it. They believe that this is the most valuable instrument for the purpose. A group of 10 pictures is selected, and the child through a process of play is trained to point to the appropriate pictures upon a command which is a carefully monitored live voice delivered through a high-fidelity amplification system. When earphones are objected to a French phone having a PDR-10 receiver mounted in the hand piece is used, since most children like to talk over the telephone. Other conditioning tests are employed if necessary, according to the intelligence and language comprehension of the child. After the extent of the hearing loss has been determined the parents are told of the possible remedial measures to be employed, such as use of a hearing aid and an educational program including speech reading and auditory training. The first step in selecting a hearing aid for the child is to accustom the child to amplified sound with a goal of establishing a true threshold. This step is carried out with a high-fidelity amplifier and earphones with good frequency-response characteristics. An auditory training program is initiated to develop awareness of sound and gross discrimination. If the auditory training program and the speech-reception test indicate that the child will profit in some way from amplification, then a hearing aid is selected. Several hearing aids are tried under careful observation, the child being permitted to adjust the loudness and tone controls to suit himself, his responses to gross sounds and recognition of picture words being noted. The instruments are then tested in a sound-treated room by means of similar tests. This method of selection permits the child to use an aid which has been fitted to his needs and prepares him to accept and wear the aid. The writers recommend that procedures similar to these be initiated as soon as there is any indication that the child may not hear. The selection of a hearing aid may take place during the first 18 months of the child's life.

65. Paris, J., and Vidal, R.: Occupational Deafness in Turbine and Exhauster Operators: (Audiometric Study), Arch. mal. profess. **13**:48, 1952.

66. Bangs, J. L., and Bangs, T. E.: Hearing Aids for Young Children, A. M. A. Arch. Otolaryng. **55**:528 (May) 1952.

Dolowitz and Stephens [67] investigated two kindreds, all the descendants of an individual, to determine and study the genetic pattern involved in cases of hereditary progressive nerve deafness. In the first kindred, 319 descendants were traced, of whom 62 had hereditary nerve deafness. The age of onset was in the early twenties; deafness occasionally was monaural in the beginning but ultimately affected the two ears equally. Deafness never became total. About one-third had tinnitus. The nerve deafness in this group was inherited as a simple Mendelian dominant trait with complete penetrance. The audiogram showed a gradual high-tone loss. In the second kindred the nerve deafness occurred only in males and was due to a sex-linked recessive gene or a possible secondary effect of pyelonephritis, which was an associated finding in the group. Which of these possibilities is correct cannot be stated until the younger members of the kindred become old enough to show the trait. Apparently there is more than one mechanism producing "hereditary" progressive nerve deafness of later life.

Thirty consecutive patients with cleft palate were studied by Sataloff and Fraser.[68] Only three of the entire series showed normal hearing on the audiogram. All the ears, including the three with normal hearing, showed some pathological drum changes. Hearing impairment varied from an average of 45 db. to a minimal loss, the predominant loss being in the low frequencies. In most of the patients the hearing loss was bilateral and of a similar pattern. Only seven had had their tonsils and adenoids removed; one of these had no hearing loss. The writers believe that ear changes are due to a disparity of pressures between the outside and middle ear. They suggest a carefully performed adenoidectomy, preferably at the time of the first operation on the palate, to prevent pathological complications in the ears. Removal of the tonsils, they suggest, should be delayed until after the age of 6 years if possible.

Saltzman [69] reports the audiometric findings in 12 unselected cases of mesencephalic or thalamic lesions produced by electrocoagulation or electrolysis. Six audiograms showed no significant changes. A low-tone defect was the most frequent finding in the remaining six. A greater contralateral high-tone loss was shown by five patients. The threshold of the middle frequencies is most stable in cases of lesions of the midbrain or thalamus, in some of which the audiogram shows a contraction of the auditory field to the right, to the left, from above, and from below. Every one of the patients showed recovery in auditory function of some degree with the lapse of time.

Scott-Moncrieff [70] presents a classification of nerve deafness similar to that suggested by Goodhill and discusses the various etiologic factors. This paper is a nice resumé of the subject.

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67. Dolowitz, D. A., and Stephens, F. E.: Hereditary Progressive Nerve Deafness, Tr. Am. Acad. Ophth. **56**:457 (May-June) 1952.

68. Sataloff, J., and Fraser, M.: Hearing Loss in Children with Cleft Palates, A. M. A. Arch. Otolaryng. **55**:61 (Jan.) 1952.

69. Saltzman, M.: Audiometric Studies Following Mesencephalotomy and Thalamotomy, A. M. A. Arch. Otolaryng. **56**:194 (Aug.) 1952.

70. Scott-Moncrieff, R.: Perceptive Deafness in Childhood, Laryngoscope **62**:1081 (Oct.) 1952.

Jones and Dinolt [71] report a case of pure-word deafness, in a 53-year-old man, following a slight cerebral accident which manifested itself as an episode of mental confusion lasting a half-hour, after which he was unable to understand speech. Seven years before he had had a cerebral hemorrhage with left hemiplegia, from which he made a good recovery. Pure-word deafness, or subcortical sensory aphasia, is a speech disorder in which the ability to understand spoken language, repeat words, and write from dictation is lost. The ability to speak, write, and read spontaneously is preserved. A discussion as to the possible pathology and a review of the literature on this subject are a part of this report.

REHABILITATION

Lederer and Marcus [72] call attention to the major needs of the deafened adult. The major responsibilty is in the hands of the otologist. The important procedures to be employed involve intelligibility testing to determine the extent of word discrimination possessed by the patient and also to evaluate the improvement in discrimination made possible with amplification in the presence of standardized noise. The selection and evaluation of hearing aids involve an inventory of all the tests made and the trial of a number of hearing aids under the same environmental conditions. A course in auditory training is given preparatory to the actual selection of the aid. The otolaryngologist must be educated in these procedures to supervise such a complete hearing and speech rehabilitation program. Such an education can be obtained at several rehabilitation centers in various university clinics. In larger metropolitan areas the patients can be referred directly to hearing centers for clinical rehabilitation as well as for hearing-aid selection and counselling.

Hoople [73] stresses the importance of the otologist in rehabilitation work. The otologist should take an active interest in the various programs pertaining to the hearing handicapped and should play an active role in the establishment and guidance of hearing centers. To be properly qualified he must be well versed in rehabilitative measures. He should know something about lip reading, the prescribing and fitting of hearing aids, speech audiometry, galvanic skin resistance, objective hearing tests, auditory training, the psychology of the deafened, and rehabilitative programs for the economically hampered hearing-deficient person. He must also take time to explain to his patients with irreversible hearing losses why they have such losses and why he cannot do anything to improve their hearing. With a proper knowledge he can then advise with regard to the various diagnostic and training aids.

O'Connor [74] asks for the cooperation of otologists in educating the public to a more sympathetic, tolerant, and patient attitude toward the handicapped deaf child. He stresses the importance of differentiating between the hard-of-hearing child and the deaf child, because each requires a different type of approach and program

71. Jones, J., and Dinolt, R.: Pure Word Deafness, Laryngoscope **62**:194 (Feb.) 1952.

72. Lederer, F. L., and Marcus, R. E.: The Adult and His Hearing Problem, Ann. Otol. Rhin. & Laryng. **61**:126 (March) 1952.

73. Hoople, G. D.: The Role of the Otologist in Audiology, Ann. Otol. Rhin. & Laryng. **60**:1049 (Dec.) 1951.

74. O'Connor, C.: The Deaf and Hard of Hearing Child, Ann. Otol. Rhin. & Laryng. **60**:1039 (Dec.) 1951.

for teaching. The hard-of-hearing child is one who has 60 db. or less of hearing loss. He can usually move along satisfactorily in or close to the program of the normally hearing child if he is given all the differential benefits he needs, such as proper seating, lip-reading instruction, a hearing aid if necessary, and individual assistance. The deaf child, on the other hand, cannot do this in and most cases should not be forced into such a situation.

Bordley [75] reports on the procedure used in examining deaf children of preschool age at the Hearing and Speech Clinic at Johns Hopkins Hospital. Over a period of two and one-half years 513 children under the age of 6 years were examined. A questionnaire was developed, and is given in detail, to provide a comprehensive evaluation of the patient's history. The child received a complete otological examination. General performance tests were also given. The hearing examination included tuning-fork tests and observations made while the child was in a soundproof room, monitored sound effects, words, and masking noises being introduced through a loudspeaker. Psychogalvanic skin-resistance tests were made on all the children, and when feasible subjective audiometry was done. Analysis of the etiologic factors produced a list of 28 categories, the largest number of factors being in the "undetermined" classification. The whole group showed a speech potential of 57.8 db. This speech potential was arrived at by using the average loss in decibels for the pure tones 500, 1000, and 2000 cps in the better ear of the patient. The writer stresses the importance of the role the otologist must play in the rehabilitation of such children.

Mrs. Spencer Tracy [76] presents the philosophy and describes the organization of the John Tracy Clinic of Los Angeles. The purpose of the clinic is to find, encourage, help, guide, and train parents of deaf and hard-of-hearing children. The first part of the program is carried out in classes for both parents. There is also a nursery school which both the parents and the child attend. The parents are taught child development, parent attitudes, and communication skills. The mother comes one day a week to observe in the nursery school and when able helps to teach others. The nursery school is primarily a demonstration school for parents and teachers. One part of the program is a correspondence course available to all parents having a preschool deaf or hard-of-hearing child under the age of 6. There are other phases of the program, such as a psychological counseling service. Mrs. Tracy makes a plea to otologists for early recognition of hearing defects in children so that they and their parents can get the advantage of such a program and begin rehabilitation as early as possible.

Hedgecock [77] discusses the counselling of parents of acoustically handicapped children. The first step is to obtain an accurate and authoritative evaluation of the hearing of the child and to inform the parents regarding this condition. The information should be presented in such a manner as not to bewilder the parents and to assure them that the handicap need not interfere with the adequate growth and development of the child. The parents in turn must take the responsibility of educat-

75. Bordley, J. E.: The Problem of the Preschool Deaf Child, Laryngoscope **62**:514 (May) 1952.

76. Tracy, S. (Mrs): The Educational Philosophy of the John Tracy Clinic, Tr. Am. Acad. Ophth. **56**:81 (Jan.-Feb.) 1952.

77. Hedgecock, L. D.: Counselling Parents of Handicapped Children, Tr. Am. Acad. Ophth. **56**:66 (Jan.-Feb.) 1952.

ing their neighbors and friends with regard to communication with their acoustically handicapped child. Parents themselves must accept their child without reservation and give him the proper love and attention. Well-established routines of rest, play, eating, and dressing are essential in efficient management of these children as well as of other children. Their activity should be guided instead of curbed. The parents must also be instructed as to what to do to promote the development of speech and language of their child. They should communicate and play with him, utilizing all the senses, with particular emphasis on vision and touch and any residual hearing the child may have.

Enrollment in a suitable nursery school is helpful in teaching the deaf child to play and work constructively with other children. If such school facilities are not available parents can follow the guidance of a correspondence course providing home training material for deaf children, such as that of the John Tracy Clinic in Los Angeles. When the child is ready for entrance into elementary school the parents must be advised as to what type of school is best suited to him. With this type of guidance and counselling parents will not be at a loss as to what to do for their acoustically handicapped children and will take an active and important part in their rehabilitation.

Francis [78] discusses rehabilitation of the deaf child. A good system of education for the deafened child depends upon four factors, namely: parental education, correct diagnosis and estimation of residual hearing; education by means of auditory training, language training, speech reading, and use of a hearing aid when indicated, and an adequate follow-up program. These factors are considered in detail. The education program is a continuous process from the time deafness is diagnosed until the child is able to continue his studies with normally hearing children. After this program a comprehensive follow-up program should be planned. Children with hearing aids must be rechecked regularly and when necessary proper training and speech instruction substituted.

Hill and Koons [79] stress the importance of auditory rehabilitation and describe their facilities and their program, which was started with little financial assistance and physical equipment 20 years ago. They present this program merely to show what can be done with very little. They insist upon the ideal not to wait for the day when all desired funds are available but to do with what you have, thinking in terms of service rather than of facilities.

Landis [80] reports on the two-year hearing survey in the public schools of Pennsylvania conducted by the Committee for the Conservation of Hearing of the Pennsylvania Academy of Ophthalmology and Otolaryngology in conjunction with the Pennsylvania Department of Health and Special Education. In Philadelphia 4% of the pupils tested revealed a hearing loss, in Pittsburgh 2.2% had a hearing loss, and in the remainder of the state 3.8% of the children had a loss of hearing.

78. Francis, G. H.: Rehabilitation of the Deafened Child, Laryngoscope **62:** 1089 (Oct.) 1952.

79. Hill, F. T., and Koons, E. O.: Essentials for Auditory Rehabilitation, Ann. Otol. Rhin. & Laryng. **61:**761 (Sept.) 1952.

80. Landis, J. E.: A Report on the Hearing Survey in the Public Schools of Pennsylvania, Tr. Am. Acad. Ophth. **56:**73 (Jan.-Feb.) 1952.

The conductive type of deafness was by far the most prevalent, the incidence being 69% as compared with 11% for otosclerosis, 10% for the perceptive type, and 8% for a mixed type of impairment of hearing.

Curry [81] made a study of spring and fall audiometric threshold changes in a group of rural Illinois children of the fifth, seventh, and ninth grades. In the spring all the children showed a loss of 30 db. or more at one or more of the frequencies tested. They were all advised to have a medical examination and treatment. The medical treatment was diversified in nature and was administered by the family physician. When the children were retested in the fall it was found that the thresholds of children who received medical treatment tended to show the same improvement as the thresholds of children who did not receive treatment. The proportion of thresholds showing improvement tended to be the same for both sexes. Those children whose thresholds showed improvement at the fall test had a poorer threshold in the spring than those who showed a decreased acuity in the fall. The writer suggests that children who show improvement should be studied separately from those whose hearing acuity decreases over a period of a study such as that reported.

In a similar survey Curry [82] reports that girls showed a general tendency to improve more than boys, but there was no significant difference between the left and the right ear for either sex. Thresholds for frequencies up to 1024 cps showed a tendency to improve more than those for frequencies above 1024. Seventy-eight per cent of the impaired thresholds showed a significant improvement in the fall test. It would appear better to do the hearing survey in the fall than in the spring. The author feels that from the present study more meaningful results will be obtained if the thresholds are considered by sex groups and specific frequencies.

Coombs [83] reports a case of severe deafness following mumps in a woman aged 36. She had a complete inner-ear loss superimposed on a preexisting conduction loss in the left ear. In spite of the severe loss this patient, through guidance, use of a well-fitted hearing aid, study of lip reading, and use of a telephone amplifier, has become rehabilitated so as to be able to continue work and social contacts. Mumps is said to cause 3 to 5% of acquired deafness in the United States. However, it occurs in only a fraction of 1% of all cases in reported epidemics.

Walsh [84] discusses the relationship of the otologist to audiology in the fields of teaching, research, and service. The otologist is an important member of a team. In the field of clinical otology he plays the important part, getting help from the audiologist in technic for diagnosis and prognosis and in the rehabilitation of his deaf patient.

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81. Curry, E. T.: Analysis of Hearing Loss Patterns in a Rural Illinois School System: Study of Ears Receiving Medical Treatment, A. M. A. Arch. Otolaryng. **56**:361 (Oct.) 1952.

82. Curry, E. T.: Analysis of Hearing Loss Patterns in a Rural School System: A Comparison of Spring and Fall Audiometric Thresholds, Ann. Otol. Rhin. & Laryng. **61**:389 (June) 1952.

83. Coombs, A. J.: Deafness Following Mumps: Rehabilitation, Laryngoscope **62**:204 (Feb.) 1952.

84. Walsh, T. E.: Audiology, Its Relation to Otology, Tr. Am. Acad. Ophth. **56**:78 (Jan.-Feb) 1952.

Directory of Otolaryngological Societies *

FOREIGN AND INTERNATIONAL

Canadian Otolaryngological Society
(Société Canadienne d'Otolaryngologie)

President: Dr. D. E. S. Wishart, 170 St. George St., Toronto.
Secretary: Dr. W. Ross Wright, 361 Regent St., Fredericton, N. B.
Place: Minaki Lodge, Minaki, Ont. Time: June 14-18, 1953.

Fifth International Congress of Oto-Rhino-Laryngo-Broncho-Esophagology

Place: Amsterdam. Netherlands. Time: June 8-13, 1953.
President: Prof. Dr. Eelco Huizinga.
General Secretary: W. H. Struben, Viottastraat 1, Amsterdam-Z
Scientific Secretaries: Dr. J. Bijtel and Dr. P. G. Gerlings.

International Bronchoesophagological Society

President: Dr. Fernand Eeman, Ghent, Belgium.
Secretary: Dr. Chevalier L. Jackson, 1901 Walnut St., Philadelphia 3.
Meeting: Second International Congress of Bronchoesophagology.
Place: Albert Plage, Le Zoute, Belgium. Time: June 15-16, 1953.

International Congress of Audiology

Place: Leyden, Netherlands. Time: June 5-6, 1953.
General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Holland

International Course in Paedo-Audiology

Place: Groningen, Netherlands. Time: June 1-4, 1953.
General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Holland.

Pan American Association of Oto-Rhino-Laryngology and Broncho-Esophagology

Meeting: Fourth Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology
Place: México, D. F., Mexico. Time: Feb. 28-March 4, 1954.
President: Dr. Justo Alonso.
Exec. Secretary: Dr. Chevalier Jackson, 1901 Walnut St., Philadelphia 3.
President of Congress: Dr. Ricardo Tapia Acuna.

Third Latin-American Congress of Otorhinolaryngology and Bronchoesophagology

Place: Caracas, Venezuela. Time: Feb. 21-25, 1954.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Dean Lierle, Iowa City.
Secretary: Dr. Sam H. Sanders, 1089 Madison Ave., Memphis 3.
Place: San Francisco.

American Academy of Ophthalmology and Otolaryngology

President: Dr. James Milton Robb, 315 Lakeland Ave., Grosse Pointe 30, Mich.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave. Bldg., Rochester, Minn
Place: Palmer House, Chicago. Time: Oct. 11-17, 1952.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

American Board of Otolaryngology

President: Dr. LeRoy A. Schall, 243 Charles St., Boston.
Secretary-Treasurer: Dr. Dean M. Lierle, University Hospitals, Iowa City.
Place: Statler Hotel, Boston. Time: May 10-15, 1954.

American Broncho-Esophagological Association

President: Dr. Edwin N. Brayles, 1100 N. Charles St., Baltimore 1.
Secretary: Dr. F. Johnson Putney, 255 S. 17th St., Philadelphia 3.
Place: Statler Hotel, Boston. Time: May 25-26, 1954 (afternoons only).

American Laryngological Association

President: Gordon F. Harkness, 215 Main St., Davenport, Iowa
Secretary: Dr. Harry P. Schenck, 326 S. 19th St., Philadelphia 3.
Place: Statler Hotel, Boston. Time: May 20-21, 1954.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Francis E. LeJeune, 49 Audubon Blvd., New Orleans 18.
President-Elect: Dr. LeRoy A. Schall, 243 Charles St., Boston.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: Statler Hotel, Boston. Time: May 18-20, 1954 (mornings only).

SECTIONS:

Eastern.—Chairman Dr. Irl H. Blaisdell, 1100 E. Genesee St., Syracuse 10, N. Y.
Place: Hotel Syracuse, Syracuse, N. Y. Time: Jan. 7, 1953.
Southern.—Chairman: Dr. W. W. Wilkerson, Jr., Curtiswood Lane, Nashville 4, Tenn.
Place: Andrew Jackson Hotel, Nashville, Tenn. Time: Jan. 12, 1953.
Middle.—Chairman: Dr. Henry L. Williams, 818 4th St., S. W., Rochester, Minn.
Place: The Drake, Chicago. Time: Jan. 19, 1953.
Western.—Chairman: Dr. Alden H. Miller, 4000 Woking Way, Los Angeles 27.
Place: The Elks Club, Los Angeles. Time: Jan. 24, 1953.

American Otological Society, Inc.

President: Dr. Frederick T. Hill, Professional Building, Waterville, Maine
Secretary-Treasurer: Dr. John R. Lindsay, 950 E. 59th St., Chicago.
Place: Statler Hotel, Boston. Time: May 16-17, 1954.

American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Harry Neivert, 555 Park Ave., New York 21.
Secretary: Dr. Louis Joel Feit, 66 Park Ave., New York 16.

American Society of Ophthalmologic and Otolaryngologic Allergy

President: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.
President-Elect: Dr. Albert D. Reudemann, 1633 David Whitney Building, Detroit 26.
Secretary-Treasurer: Dr. Michael H. Barone, 468 Delaware Ave., Buffalo 2.
Place: Palmer House, Chicago. Time: Oct. 16, 1953.

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The new filter material—called Micronite—stems directly from the improved protective filters developed to meet critical air-purification problems in atomic energy plants.

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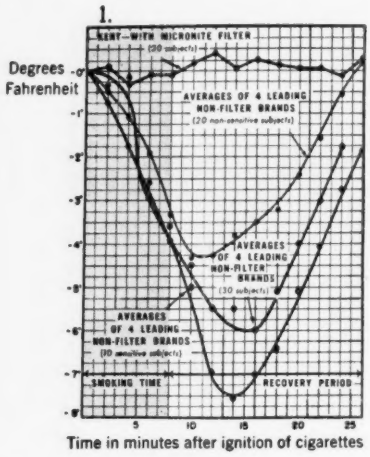

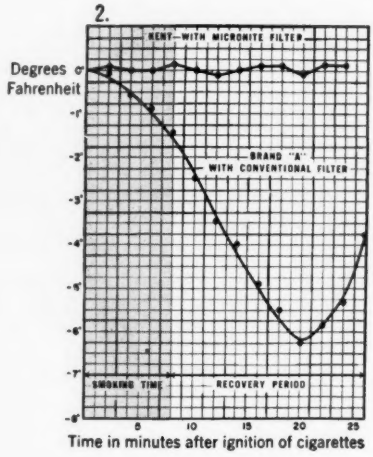

1. Comparison of KENT with leading non-filter brands. Effects on Peripheral Vascular System. Drop in surface skin temperature at the last phalanx induced by smoking one cigarette.

2. Comparison of KENT with Brand "A" conventional filter tip. Effects on Peripheral Vascular System. Drop in surface skin temperature at last phalanx induced by smoking one cigarette. Average for 15 susceptible subjects.

matic smoke constituents, but with a removal of the more objectionable fractions of tobacco smoke to an extent never before accomplished.

Efficacy of the Micronite Filter

The normal human subjects used in testing the Micronite Filter were divided into two categories—*susceptible and non-susceptible*—on the basis of their subjective reactions to cigarette smoking. Approximately two-thirds of the subjects *in this investigation* were *non-susceptible* while the remaining third were definitely *susceptible.* Other investigations have reported a somewhat similar ratio. (a)

To study the effects of this filter on physiological reactions to cigarette smoke, in both *susceptible and non-susceptible persons,* two different tests were employed, both being measurements of peripheral blood flow.

The first test involves the drop in skin temperature occurring at the finger tip, induced by smoking and measured according to *well-established procedures.* (b, c)

The second test is a measurement of vasoconstriction in the hand, as recorded plethysmographically. (d)

The results of these measurements—determined for Lorillard by an independent research organization—are shown on the four charts reproduced here. Concurrently, other outside independent laboratories are carrying on further research on the chemical and physiological effects of cigarette smoking *with new and original testing methods.*

From these charts, the following general conclusions may be drawn:

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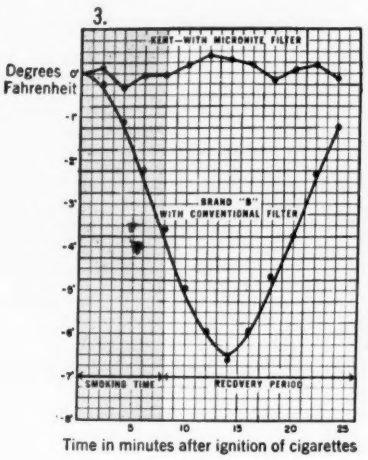
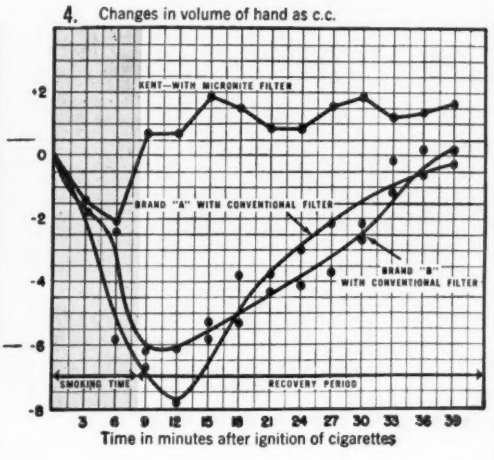
The Micronite Filter is vastly superior to *any other available filter now in use* for




4. Changes in volume of hand as c.c.
KENT—WITH MICRONITE FILTER
BRAND "A" WITH CONVENTIONAL FILTER
BRAND "B" WITH CONVENTIONAL FILTER
SMOKING TIME
RECOVERY PERIOD
3 6 9 12 15 18 21 24 27 30 33 36 39
Time in minutes after ignition of cigarettes

3. Comparison of KENT with Brand "B" conventional filter tip. Effects on Peripheral Vascular System. Drop in surface skin temperature at the last phalanx induced by smoking one cigarette. Average for 15 susceptible subjects.

4. Comparison of KENT with Brand "A" and "B" conventional filter tip. Peripheral vasoconstriction induced by smoking one cigarette. Peripheral blood flow as measured by continuous plethysmography on the hand. Average for 4 susceptible and 8 non-susceptible subjects.

removing tars and nicotine in cigarette smoke.

Here are additional observations from work now in progress:

1. When smoke which has passed through a Micronite Filter contacts the conjunctival sac of the rabbit, far less irritation occurs than when the sac is exposed to the smoke from regular cigarettes or the smoke from popular filter-tipped brands.

2. Current studies also indicate that Micronite-filtered smoke is less irritating to mucous membranes than unfiltered smoke. When the scientific evidence of the effectiveness of the Micronite Filter is compared *with* the effectiveness of other filters, *it shows that*—

The problem of smoker susceptibility to tobacco irritants may be largely overcome by KENTs. And for those people whose smoking should be restricted for therapeutic reasons, *KENT should be considered as the cigarette of choice.*

References Cited

a. *A Manual of Pharmacology*, 7th edition, Philadelphia, W. B. Saunders Co., 1949, pp. 341-352.

b. *J.A.M.A.*, Vol. 103, 1934, p. 318.

c. *J.A.M.A.*, Vol. 135, 1947, p. 417.

d. *J.A.M.A.*, Vol. 104, 1935, p. 1963.

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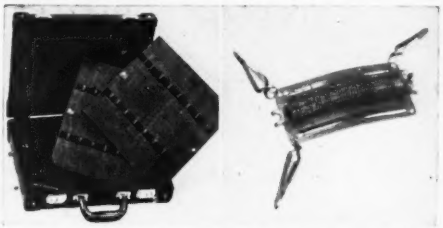

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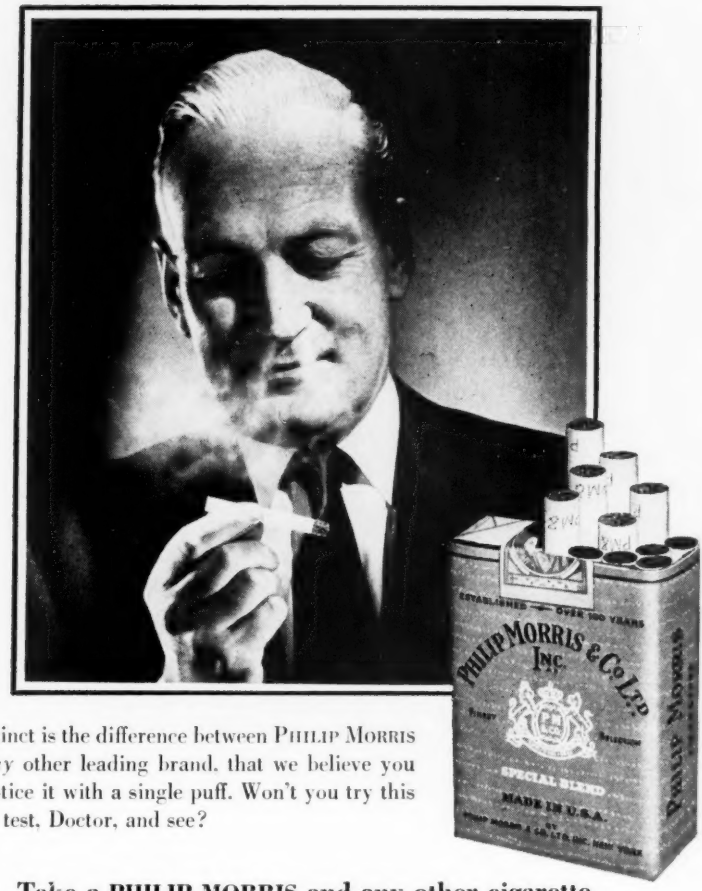

So distinct is the difference between PHILIP MORRIS and *any* other leading brand, that we believe you will notice it with a single puff. Won't you try this simple test, Doctor, and see?

Take a PHILIP MORRIS and any other cigarette

1. Light up either one first. Take a puff—get a good mouthful of smoke—and s-l-o-w-l-y let the smoke come directly through your nose.
2. Now, do exactly the same thing with the other cigarette.

You will notice a distinct difference between PHILIP MORRIS and any other leading brand.

PHILIP MORRIS

Philip Morris & Co., Ltd., Inc., 100 Park Avenue, New York 17, N. Y.

NEO-SYNEPHRINE®

HYDROCHLORIDE

. . . reduces nasal engorgement . . .

. . . promotes aeration . . . encourages drainage

A few drops of Neo-Synephrine 0.25% in each nostril will promptly check mucosal engorgement and hypersecretion, promoting greater breathing comfort over a period of several hours.

The resultant relief to the hay fever sufferer is decidedly gratifying. Prolonged action of Neo-Synephrine makes fewer applications necessary, consequently longer periods of rest and sleep are possible.

Neo-Synephrine does not lose its effectiveness on repeated application and may, therefore, be relied upon to give relief throughout the hay fever season.

Neo-Synephrine is practically free from sting and compensatory congestion; does not appreciably inhibit ciliary activity. Neo-Synephrine has been found relatively free from systemic side effects such as nervous excitation, cardiac reaction or insomnia even when tested on hypertensive, cardiac and hyperthyroid patients.[1]

Supplied in 0.25% solution (plain), bottles of 1 oz., 4 oz. and 16 oz.; 0.25% solution (aromatic), bottles of 1 oz. and 16 oz.; 0.5% solution, bottles of 1 oz.; 1% solution, bottles of 1 oz., 4 oz. and 16 oz.; 0.125 (⅛)% solution, bottles of ½ oz.; 0.3% water soluble jelly, in ⅝ oz. tubes.

1. Van Alyea, O. E., and Donnelly, Allen: *Arch. Otolaryng.*, 49:234, Feb., 1949.

Winthrop-Stearns INC.
NEW YORK 18, N. Y. WINDSOR, ONT.

Neo-Synephrine, trademark reg. U.S. & Canada, brand of phenylephrine.